The FOUNDRY

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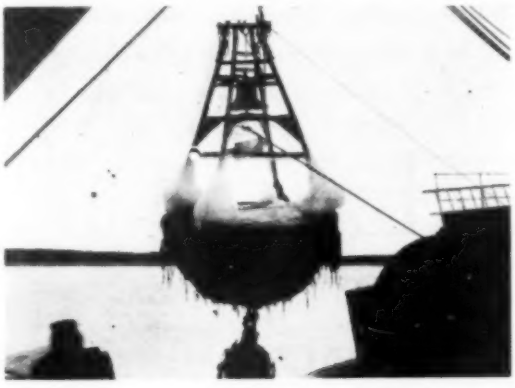
Castings Warn Navigators of Dangerous Spots

STEEL and gray iron castings are important units in the construction of buoys of all classes, appendages and moorings, and other aids to navigation. Steel castings are of soft steel specifications and tested for tensile strength to 60,000 pounds. Phosphorus must not exceed 0.06, sulphur 0.06 and carbon 0.35. Tests in all light house materials are unusually severe due to the heavy pounding received by buoys and chains. At least one tensile and bend test is made for each lot of 25 castings, steel or iron. Ballast balls and counterweights used are gray iron cast around wrought iron bars. Sinkers are made similarly and both are heated and bathed in hot tar as a final operation. The bell is of 80 per cent copper and 20 per cent block tin. These average 225 pounds each, but some weigh close to a ton. Cast steel mushroom anchors are cast up to 7000 pounds, including shackle and cast iron anchors up to 7760 pounds. As ballast balls, counterweights and sinkers are all castings and are heavy units, the total tonnage of iron and steel castings entering into buoys and moorings is impressive.



Courtesy U. S. Lighthouse Service

Many Gray Iron and Steel Castings Are Used in Buoys

Find Where Castings Can Be Sold.

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Fig. 1—Iron Comes From the Spout at 2800 Degrees Fahr. and Is Carried To the Molding Floors on the Conveyor System

Close Control Cuts Losses in Piston Ring Castings

DURING the first six months of 1931, the Perfect Circle Co., with headquarters and main plant at Hagerstown, Ind., cast 27,371,417 individual piston ring castings at its modern foundry located at New Castle, Ind., just 10 miles from the main plant. In manufacturing that large number of gray iron castings, the foundry losses, including all of those traceable to men, materials and equipment, were less than 5 per cent of castings produced. Considering the most stringent requirements regarding defects of every type in piston ring castings, that enviable record was made possible only through absolute control of all foundry operations.

Fig. 2—Finished Piston Ring Showing Oil Drain Slots

The Perfect Circle Co. first was organized in 1895 under the name of the Railway Cycle Mfg. Co. To provide a name more descriptive of its first product, a small railroad inspection car, the name was changed in 1900 to the Light Inspection Car Co. In 1905, the company started manufacturing automobile cylinders, pistons and pins and later it designed and built a complete motor, which was known as the Teetor motor. The company first entered the piston ring field in 1907. The name of the firm was changed to the Teetor-Harley Motor Co., in 1914, but in 1918, the name again was changed

By
Frank G. Steinebach

to the Indiana Piston Ring Co., and the manufacture of motors was abandoned. The present name was adopted in 1928 with the purchase of the General Piston Ring Co., of Tipton, Ind. The capacity of the three plants is approximately 5,000,000 piston rings a month.

For many years the company purchased all of its ring castings from various sources of supply, but in 1927, the management purchased a large, practically new building on the outskirts of New Castle, which originally had been built for the manufacture of rubber tires, and installed a foundry. While numerous changes have been made from time to time, in general the layout of the plant is much the same as originally designed. This speaks well for the care that was exercised in making the original plans.

The main foundry building is approximately 60 x 240 feet and of 2-story construction with a balcony provided along the entire front side and the two ends between the first and second floors. The basement is used for sand storage, the first floor for molding, cleaning and inspecting, the balcony for the chemical laboratory, offices, machine department and sample department, and the second floor for the main molding department. A former power house contains a heating unit for the building, a ladle dryer and the compressors and blowers.

The sand storage in the basement has a capacity for approximately 800 to 1000 tons.

Fig. 4—A Compensating Channel Aids in Oil Control

The material is received on a siding from the Pennsylvania railroad, which runs along one end of the building, is unloaded into wheelbarrows, hauled a short distance and dumped into the storage through openings in the floor. A variety of sands are employed in the molding sand mixture used in the foundry, including grades from the Albany, Sandusky, Evansville, and Zanesville districts, as well as a high silica sand and a red bond. Various standard mixtures have been developed over a period of time.

Roots and other foreign materials are cleaned from the sand in the storage room, various types of equipment being used for the purpose, including a sand separator and blender made by the Royer Foundry & Machine Co.,

Fig. 3—Stacks on the Molding Floor Are Located in Rows Parallel to the Overhead Track

Fig. 5—Sample Castings Are Machined and Tested Daily at the Foundry

Wilkes-Barre, Pa., and equipped with a special vibrating screen built by the foundry, a screen supplied by the Deister Concentrator Co., Ft. Wayne, Ind., and a vibrating type riddle made by Foundry Supplies Mfg. Co. Chicago. The sand is mixed properly for adding to the heaps before it is taken to the first and second floor molding departments in a bucket of approximately 700 to 800 pounds capacity, which operates on the complete monorail system with which the plant is equipped. The entire monorail system was manufactured by the Louden Machinery Co. Fairfield, Iowa.

Work on First Floor

Fifteen molding stations are located on the first floor. Metal for the molds is supplied by a cupola, designated as No. 3, which is lined to 29 inches and has a capacity of from 2½ to 3 tons per hour. When the first floor is working at full molding capacity, five floors at one end usually are poured with metal brought from the cupolas located on the second floor, approximately 60 seconds being required to make the transfer from one floor to the other. Ordinarly, rings of fairly large section are made on the first floors poured in the manner described, to compensate for the cooling of the iron that takes place while the transfer is being made. Two jobbing floors are located on the ground level to make flasks and other castings needed in the foundry. The molds on these floors are poured with the first iron that comes from the cupola.

The main molding department is located on the second floor, with 45 molding stations situated along the two sides of the building, as may be noted in Fig. 3. Two cupolas, supplying the metal for the molds are at the middle of one side of the building, as shown in Figs. 1 and 3.

Molding piston ring castings is an interesting and highly specialized art. All patterns utilized in the manufacture of piston ring castings are mounted on plates for machine molding. The number of rings on each plate is governed by the size of the casting to be made. Large rings are mounted separately, while with the smaller sizes, two, four or six rings are arranged around a single sprue. One pattern plate consists of two circles of four rings each, with two sprues provided through the stack. The pattern is molded in a rectangular flask and the two sprues are filled with metal, one following the other.

The ring patterns are gray iron and are riveted to the heavy iron plate. To compensate for the cut which must be made through the ring during the machining operation, the pattern is made with a slight flat place at one point. After the ring casting has been cut at that point, and the two ends forced together, the ring forms a perfect circle. The flat place in the ring is located at the point where the gate is attached to the ring.

Adopt Standardized Gate

After experimenting with approximately 200 different styles of gates, the company has standardized on one general type. The gate, with the exception of the portion forming the sprue, is cast in one piece in bronze, machined to careful limits and also is riveted to the iron plate. The gate consists of the sprue, which extends through the entire stack of molds, the leader or choke, the ring gate on which shrink bobs are mounted and the actual gates or runners which extend from the ring gate to the piston ring pattern. The gate, which is used on the plate containing four piston ring patterns has four choke gates leading to the ring gate. Of course, the choke gates and the runners to the castings are staggered, so that one choke reaches the ring gate exactly half way between the runners. A plate having six rings in the circle is provided with six choke gates and six runners. Since the castings on the six ring plate are smaller than those on the four ring plate, the size of the chokes and runners is arranged so that the ratio of the cross section of the choke to the size of the casting is the same as with the four pattern plate.

Used for Stars

A feeder, called a *polliwog* in the parlance of the piston ring foundry, is placed directly opposite the point where the runner is attached to the casting. The feeder may be placed either inside or outside of the ring. The feeder is necessary to feed the casting and prevent misruns because the section of the casting is so thin. The company has developed a special shape for the polliwogs so that they may be used as stars in the tumbling barrels after they are stripped from the castings.

To facilitate speed in the molding operation, the company has done considerable development work in connection with the molding machines. A special table with stripping pins and a pneumatically operated head, as shown in Fig. 6, has been designed and built in the foundry machine shop for use on a power squeeze type ma-

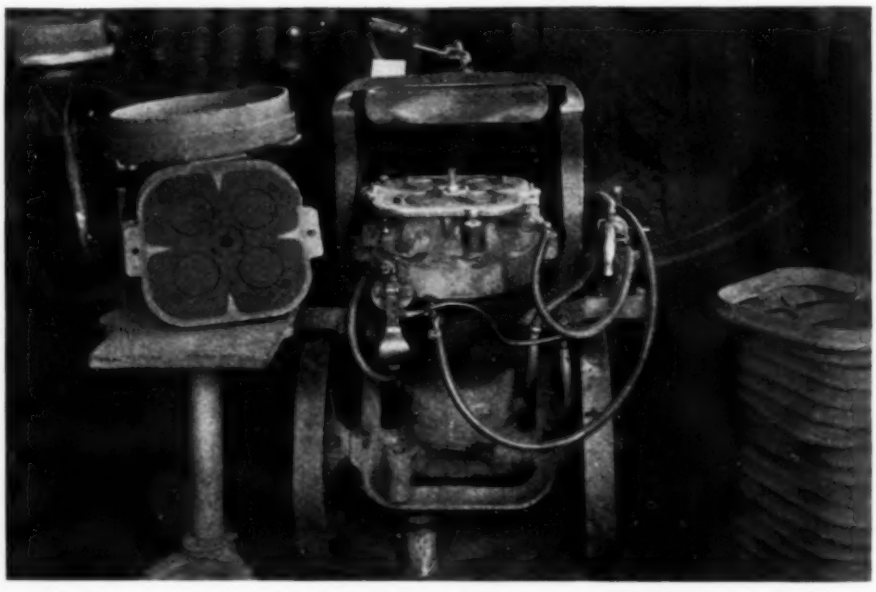


Fig. 6—Special Equipment Has Been Developed To Speed the Production of Molds

chine supplied by the Osborn Mfg. Co., Cleveland. The pattern plate is bolted on the table head with the sprue, which also is integral with the head, extending through the hole in the center of the plate and gate, as shown in Fig. 6. During the squeezing operation, the sprue extends into the hole provided in the head. The head is swung into position for squeezing and is returned to the back position, which permits other operations to be performed on the mold, by a pneumatic cylinder in the back of the head and mounted on the frame of the machine. A small valve on top of the head, which may be seen in Fig. 6 is used by the operator to govern the operation of the cylinders and the movement of the head. Electric heating elements, provided in both the table and the head, keep the pattern plate and the head at the correct temperature to prevent the sand sticking. Some of the heating elements are equipped with a thermostatic control.

The operations required to make a mold are so simple and the equipment is so well designed that the production per man per machine is exceptionally high. For example, one operator has produced as high as 85 stacks of molds in an 8-hour day, a total of 1530 individual molds since each stack is 18 molds high.

Making the Mold

In making the mold, the operator places the flask on the plate and then sets a riser band or frame on top of the flask. He riddles sufficient sand in the flask to cover the pattern and then shovels in sand to fill the flask and frame. He then strikes off the sand, removes the frame and swings the head into place by operating the lever previously mentioned. A downward movement of the lever, shown at the right of the machine in Fig. 6, completes the squeezing operation by causing the pattern plate to move up pneumatically against the machine head.

Fig. 8—Complete Analysis Is Made of All Materials Used in the Foundry

At this point the operator performs four operations almost simultaneously. With his left hand he actuates the valve handle previously mentioned, which causes the head to be swung back. He makes a second downward movement of the handle at the right of the machine which causes the plate to drop to its original position and with the same hand squeezes up on the lever, located immediately below the handle, to set the vibrator attached to the pattern plate in operation.

Stripping Pins Operate

As the head swings back and the plate starts to drop, he pushes the knee lever at the left of the machine. This causes the stripping pins which may be seen in Fig. 6, to move upward through the descending pattern plate, engage the bottom of the flask and raise the flask and the mold from the pattern plate. While the pins are moving upward, the sprue drops to the level of the plate. Since the mold is entirely free from the plate or sprue, it is not necessary for the operator to lift it in an absolutely vertical direction. As the operator lifts the mold, he releases the pressure on the knee valve, the stripping pins drop to their original positions and the sprue pin is raised for the molding operation. The lifting pins are raised pneumatically and are returned to position by springs while just the opposite is true with the sprue pin.

As he lifts the mold away from the machine, the operator blows through the opening made by the sprue pin to dislodge any loose sand that may have remained. He places the mold on a table at the right of the machine, and each succeeding mold is placed on top of one another until a portion of the stack has been completed, when he places it on the floor. This operation is continued until the stack on the floor has 18 molds. Extreme care must be exercised to align the molds perfectly, and this is accomplished with the aid of two vertical rods on the table at the side of the machine.

Fig. 7—Sand Storage with a Capacity of 1000 Tons Is Located in the Basement

Dummy Mold Carried on Racks

Two machines, one located at each end of the building, make dummy molds for the bottom or foundation of the stack. A rack, carried on the monorail system is used to transport the dummy molds to the various molding stations. In stacking the molds, it is desirable that the sand in the mold be slightly higher than the flask. The frame, previously mentioned, is so designed to provide sufficient sand to give an ⅛-inch thickness of sand above the flask after squeezing. The riser band or frame is approximately ¾-inch high. A perforated skimmer is placed over the sprue opening on the top mold.

An exceptional view of the arrangement of the stacks on the foundry floor shortly after the pouring has started is shown in Fig. 3. As may be noted, the stacks are arranged in straight rows throughout the length of the molding floor with a gangway

for pouring between alternate rows of stacks. Yellow lines painted on the concrete floor, show the operator exactly where to place each row of stacks. Metal is carried from the cupolas in ladles supported by the monorail extending down the center of each gangway. Each ladle carries approximately 165 pounds of iron, sufficient to pour from four to six stacks, depending upon the size of the rings in the molds. Approximately 8 seconds is required to pour one stack.

Metal is melted in three cupolas, one being located on the ground floor and two on the second or main molding floor, as previously mentioned. The cupola on the ground floor is charged from the second floor and the two larger melting units, designated as Cupolas Nos. 1 and 2, are charged from a new platform recently completed on the third floor. The new charging floor is equipped with roof ventilators and propeller type fans to improve the conditions under which the men on the platform must work.

Charging the Cupolas

An elevator of 4000 pounds capacity, located immediately in the rear of the cupolas, transports materials to the charging platforms. Iron charges are made up on the first floor and are carried to the platforms on hand operated trucks. Iron is charged by weight, coke is charged by volume, limestone is measured by the shovelfull and fluorspar by weight, a small scale on the platform being used to weigh the latter material. All charging is done by hand.

The cupolas are lined with a fire stone of high silica content, used in the natural state. The stone is amorphous and is said to have been formed by nature under an enormous pressure. No. 1 cupola melts 4.7 tons per hour and No. 2 cupola 5.5 tons per hour, each unit being lined to 45 inches. A lining gives from 16 to 18 heats. Blast is supplied by three blowers supplied by the P. H. & F. M. Roots Co., Connersville, Ind. The blower supplying the blast for cupola No. 2 is being equipped with a variable speed drive made by the Reeves Pulley Co., Columbus, Ind. A control panel will be installed immediately in the rear of the cupola, and a blast meter, made by the Chas. J. Clark Blast Meter Co., Gladbrook, Iowa, a pressure meter, with a barometer and other recording instruments will permit absolute control of the cupola blast to compensate for atmospheric and other conditions. The company has undertaken considerable research with reference to the proper control of the cupola blast and its relation to foundry losses.

Stacks of molds are shaken out by the night gang and the rings produced by each molder are placed in separate barrels for transportation to the cleaning department located on the ground floor. Sand is conditioned with six sand separators and blenders supplied by the Royer Foundry & Machine Co., Wilkes-Barre, Pa. The amount of water to be added to each heap is specified by the laboratory at the close of each working day. This amount varies according to the number of stacks on each floor and the section of the ring molded.

The night foreman varies this amount of water to be added so that the heaps have a moisture content of from 5.5 to 6.5 per cent, checking with a moisture meter supplied by the R. W. McIlvaine Co., Chicago. The amount added to each floor is noted in the night report by the foreman. Sand samples are checked daily in the laboratory for moisture content.

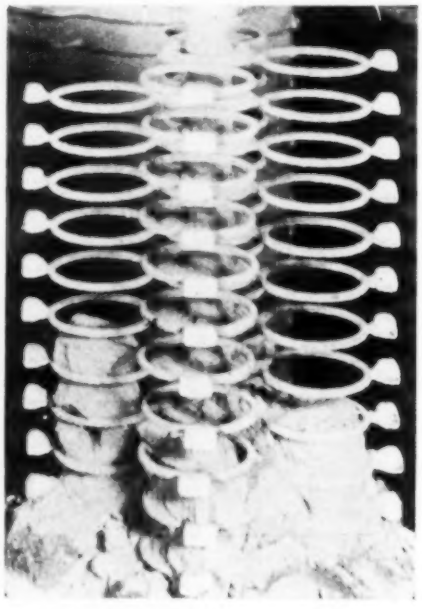


Fig. 9—Molds Are Stacked Eighteen High for Pouring

Castings are tumbled approximately 24 minutes, six round tumbling mills and also a continuous mill, the latter supplied by N. Ranschoff Inc., Cincinnati, being used for the purpose. The ring castings are then replaced in the barrels, with each molder's work again kept separate, and taken to the inspection department. Girls, highly skilled in their particular work, inspect from 35,000 to 45,000 rings a day, separating the castings in four groups as follows: Good rings, bad rings due to molders' losses, bad rings due to foundry losses, which cannot be charged to the molder, and rings that need grinding.

Pay On Bedaux System

Payment of foundry employes is determined by the Bedaux system, which takes into consideration the factors of skill, effort and speed. Since the skill of the molder is measured by the number of bad castings that are chargeable to him, he is anxious to determine the reasons for the losses. Therefore a rack is provided in the inspection department, which contains a metal box for each molding floor. The inspector marks the bad rings for each particular molder's defect, places them in the box in the rack where the molder is permitted to examine them and ask any questions if the reason for the discard is not clear. A rack with individual boxes for each molding floor also is provided to hold the defective castings classified as foundry losses and the molding foreman examines these rings daily. The good castings then are taken to the shipping department, weighed on a special scale to determine the number of individual rings and shipped to the factories at Hagerstown or Tipton.

As mentioned at the beginning of this article, complete control of all operations is absolutely necessary in the production of piston rings. For that reason the company maintains a sample department to provide a thorough check on the rings produced. From 0.5 to 0.7 per cent of the daily production of rings is taken from the barrels after the tumbling operation and sent to the sample department of the foundry. This represents from 800 to 1500 rings a day or approximately 65 rings from one floor. The sampling is rotated so that the rings made by each individual molder are sampled once every three days.

Sample Two Stacks

These rings are machined, as they would be at the factory, and are then inspected for all defects that would cause them to be discarded in the final inspection. They also are tested for hardness on a Rockwell machine and are inspected for tension. If over 12.5 per cent of the rings show gas and dirt holes, or if over 2 per cent of the rings are found to have hard spots, the entire day's production of the molding floor where the rings were produced, is junked. After the inspection, the sample department junks the good rings and the bad castings are sent to the research department for a careful check and study.

In addition to the sample rings tested, the company also makes two special stacks of molds each day as an iron check. These stacks are made each day by the same man on the same machine with all other variables as nearly identical as possible. The molds are poured at the same time each day, the first exactly one hour after the blast is put on the cupola and the other two hours later. These castings are machined daily by the same man and inspected by the same employe.

While this infinite amount of inspection may seem beyond the realm of necessity to the average foundryman, it constitutes only a fraction of checking that is made a part of the daily routine of that plant. All materials received, such as pig iron, coke, sand, etc., are analyzed by the metallurgical department. Molding sand samples are taken daily and tested according to the standards established by the American Foundrymen's association.

(*Concluded on Page* 46)

Apprenticeship Training Course Requirements Vary Widely

By S. M. Brah

APPRENTICESHIP has been defined as the training of the hand and mind in the science of a craft or trade. While apprenticeship laws always have required that the master teach the apprentice the entire trade and provide necessary schooling, there was no interpretation as to what *necessary schooling* should include.

Everyone agrees that a well-organized apprentice training program should include some school work, but there is little or no agreement, even among educators as to what the curricula of the apprentice course should contain. The author sent out questionnaires to more than 100 plants and communities to collect data on class-room training for apprentices. The difficulty found in compiling this sketch of the situation, and the general interest shown in the problem during collection, indicates the need for continuous collection and thorough study of facts of this nature by everyone associated with the training of apprentices.

Cover Wide Scope

It is increasingly evident that the curricula of the apprentice school must be varied widely in nature, and to add this difficulty, only one teacher usually is available to instruct the group in all branches. In addition, the teachers of these classes are faced every day with new problems which make demands on all their resources. These problems, with pupils in various periods of life, previous training and mental capacity, demand teachers of exceptional qualifications as to personality, experience and training.

For academic and related subjects, it is necessary that the teachers should have had, if not actual industrial experience, at least close contact with industry, and that they should be close and interested students of industry and industrial conditions generally. However, another thing also is essential, that is, a knowledge of the subjects they are to teach, a knowledge so thorough that the teachers will be free to give their attention to the pupils and their individual needs.

Class-room training should cover the same period as the shop course and not be condensed into two years or less, which makes the training given dependent upon deferred values for its justification. Many schools are laboring under a natural but unfortunate handicap. Methods established in the regular full-time schools have carried over to this part-time system. Apprentice classes should be open so that students can be enrolled at any time, and the text material and methods of instruction should be such that each student can proceed at the rate dictated by his previous training and mental capacity.

Material should be prepared that is entirely self-explanatory. This will enable the class-room supervisor to permit each student to work on such subjects as he is at that time engaged in at the shop. Thus, if he is working on the cupola, he should be studying the cupola and its operation. This qualification prohibits carrying the class as a group, which should be discouraged. From data at hand, we are forced to believe that under many of the established systems, the previously mentioned conditions cannot be met.

School shop or place of work, fitted with the equipment and materials of the shop, is too costly to be demanded of the small employer or poorer school districts. The same results can be achieved through shop training entirely.

The ability of these pupils to do thorough work and digest a wide variety of mental diet has been proved in a few isolated programs. We need have no fear for the inferior mentality of the apprentice from those who go on through high school or college. Many of our apprentices are high school graduates, which in itself it a stamp of their mental qualifications, and in no case does the author know of a program that welcomes those mentally slow or deficient.

S. M. Brah, Apprentice Supervisor, Tri-City Manufacturers Association is also Secretary the Quad-City Foundrymen's Association

The author is of the opinion that the problem of the apprentice course is to offer variety of the right kind. Abstract mathematitcs of elementary character is offered in most classes, and it affords a much-needed opportunity to review this subject. The practical application of elementary mathematics is given without exception and should form the major portion of this course. Trigonometry and geometry are offered in several schools and shops, and it has a limited use in foundry practice. Algebra has difficulty in justifying itself in a foundry apprentice course for its practical value.

Co-ordination Should Exist

Co-ordination between mathematics and related information should exist to firmly establish the principles involved in the student's mind. The amount of time spent on mathematics will be determined by the apprentice's mental capacity, rather than by some standard established by regular school practice.

The need for science in the form of selected chapters of a physics course, and the fundamentals of chemistry is recognized almost universally. In some cases, the science course has been substituted for related information. While it has

Conducts Survey

AFTER sending out questionaires to more than 100 plants and communities to collect information on class-room training for apprentices, the author, who is apprentice supervisor, Tri-City Manufacturers' association, has assembled the data and analyzed the various subjects taught. The article is abstracted from a paper presented at the Chicago convention of the American Foundrymen's association.

much practical value, it is related somewhat indirectly.

The need for economics forcibly was brought to the attention of the author while conducting classes a number of years ago. An apprentice working in the foundry of a plant went to the office to purchase a gear which he was at that time engaged in making in the foundry. He was paid 4 cents per mold which contained 6 gears, or at the rate of ⅔-cents per gear. When he was told the price was 84 cents, he could not reconcile this increase in cost with his meager knowledge of economics. Economics has a definite place in any training program, for no better means of establishing the importance of economy and efficiency exists than in the lessons in the principles of economics that treat with value, organization and overhead.

Teaches Sketching

Drawing and blueprint reading have been grouped under one heading because of their natural relationship. Geometric and mechanical drawing have well-defined values to the foundry apprentice. The danger lies in overemphasizing the importance of this subject by providing too extensive a course. The fundamentals of drawing can be taught in a relatively short period of time. Sketching has a more immediate and practical value to the foundryman and unfailingly should be included in the drawing course. It lends itself to a wider field of drawings in the same period of time and also teaches the principles.

It may be well to define related information. It is that information which is directly related to trade processes and practices, and differs markedly from auxiliary information and abstract mathematics, science, drawing and the like, in that the latter are related only indirectly. The municipally conducted schools, offer thorough courses in molding, core making, melting, cleaning and other trade technique, more often than the plant operated school.

While the training in the shop may be thorough and modern in every respect, no single shop incorporates every known device or process as illustrated in the courses and texts used in many classes. In addition, the foremen, instructors or other employes often are too busy and not well enough informed on some of the points raised by the apprentices. The well-organized course contains detailed information on green-sand molding, including various type of machine molding, core making, dry-sand and loam molding, mixing cast iron, cupola practice, elements of chemistry, foundry chemistry, metallurgy of iron and steel, foundry appliances and equipment, heat treatment of iron and steel, and information relating to materials used, as well as methods of testing raw materials and finished products.

Due to the many changes and additions in processes and equipment and methods of testing, it becomes necessary to supplement any course with business papers and the *Transactions* of the American Foundrymen's association. Catalogs and hand books have a definite place in this department of the school.

Again, attention is called to the comparative lack of interest among plant-operated classes for extra curricular activities. Various municipal schools offer movies of shop processes, talks on safety and industrial subjects, and a number of visits to other industries. The value of these variations from regular class-room routine may be intangible, but experience has proved that they materially aid the instructor to hold interest and broaden the training of the apprentice. Apprentices can be used in many cases to make researches of minor proportions, to gather data for use in the class room and to check various formulas originated from time to time against actual practice in an individual shop or the community as a whole. Contests should be arranged in academic as well as in practical work.

In almost every case the apprentice is paid for attending school. This practice is commended as the most practical, and certainly it is a fair one to the apprentice. It enables the employer to demand attendance and set standards of quality and quantity of work done.

Among the municipally conducted apprentice schools, we find a reluctance to invite the manufacturer to assist in the administration of the school. This seems unfair. The interest of the manufacturer is involved vitally. He usually is one of the largest tax payers in the community, and the responsibility for the welfare of the apprentice has been placed upon the employer under the old apprenticeship laws and by recent legislation.

Control Cuts Losses

(*Concluded from Page* 44)

Three or more test bars are taken from each heat and analyzed to determine the chemical composition of the iron. Furthermore, the temperature of each tap is determined by an optical pyrometer. In the latter connection, a rather ingenious system has been developed to permit one man to take the temperature readings of the cupolas on both the second and first floors without running back and forth. A metal tube extends vertically from the second floor to a point directly above the spout of the cupola on the first floor, and by placing the pyrometer over the top of the tube the checker can determine the temperature of the metal flowing from the lower cupola.

To provide a means of recording the vast amount of information that is collected daily, the company has developed an elaborate system of report forms. These include the floor report, inspection report, night report, sample report, cupola report, daily iron check, a daily report to the main office, a daily record of metal at the cupola spout, and an index that provides a ready reference to all of the other reports mentioned. While the system of reports is too extensive to describe in detail in this connection, a few of the features will be discussed.

Make Floor Report

The floor report contains the following information: Foreman, heat date, floor number, molder, machine number, pattern number, gate number, type of sprue, machine defects and pattern defects that may develop during the course of the work, air pressure, stacks that may be bumped or otherwise damaged, runouts, stacks poured short, moisture content of the sand as determined by foreman, night foreman and molder, sand added to the heap and the reasons for the addition, iron, the results of Rockwell tests and the rough tension tests, etc.

The inspection report lists the number of bad castings according to the various defects. Under molder's loss the following defects are listed: Swell, dirty back, stickers, ram off, crushed. The foundry loss includes the following: Bumped, broken, runout, washed, kish, top dirt, misrun, cold iron, shrinks, gas, broken gate, broken polliwog. The report also includes the floor number, inspector number, number and per cent of bad castings chargeable to molder's loss, number and per cent for foundry loss, total rings made for each floor, number, percentage and weight of rings shipped, kind and number of tests made, number of rings tested, and the grinding performed.

The night report gives complete information on the tempering of sand and the results of sand tests, the number of rings left in the heaps and the stacks and rings short. The sample report shows the floor from which the samples were taken, the pattern, date, gate, sprue, the number of rings lost classified as to the various losses, Rockwell tests, tension tests, number of rings tested and the per cent of loss.

The report sheets are perforated and are bound in book form. With the aid of this information it is possible to maintain a complete check of all variables. If the machine shop finds an unusually high percentage of defects in any particular shipment, the information is available to determine the cause and corrective measures can be provided. In fact, it is the collection, study and use of this vast amount of information that has permitted this foundry, producing almost a quarter of a million individual gray iron castings daily, to continually reduce its foundry loss since the time the plant first was placed in operation.

Prevent Losses With Proper Gates and Risers

By Pat Dwyer

ONE of the reasons for placing a large sink head, feeder, or riser opening on top of a mold is to provide a place for the reception of any dirt that may come floating up on top of the iron as it rises in the mold. In many instances the expectation of the foundryman is verified. Foreign material actually does float into the space provided for its reception. This body of metal later is removed from the casting. However, in many instances, as pointed out previously, the foreign material shows an aggravating and disconcerting habit of clinging to the surface of the mold or core and as a result, never reaches the riser.

Height Increases Pressure

The main reason for placing a riser on a mold is to take advantage of the fact that molten metal is subject to the law which governs all metals, a law by which the pressure is increased in proportion to the height of the head. Metal in a gate of comparatively small cross section will solidify before the metal in the casting solidifies, therefore the only way to secure the advantage accruing from a high head is to provide a head in which the metal will remain liquid for a longer period than it does in the casting.

Since gravity also plays an important part in all shrinkage problems, it is apparent that the head provides a reservoir of liquid metal from which a supply is drawn downward to compensate for the loss of volume as the metal in the casting passes from the liquid to the solid state. Cylindrical heads, enlarged extensions of the casting are employed extensively, particularly on castings designed to meet severe specifications.

The height and shape of the cylindrical head varies to a considerable extent, depending on many factors, the character of the iron, the position of the gates, and perhaps principally on the empirical opinion of the man in charge. He in turn, bases his opinion on that somewhat intangible, but nevertheless important factor known as experience. He has seen many heads tried on a variety of castings over a long period, and he has had opportunity to note the result in each case. Naturally the foregoing applies only to observant men. Unfortunately in many instances the important feature of applying a proper head is decided by men who are not qualified. Many observant men have not had sufficient experience and therefore are likely to draw erratic conclusions. Many men of long experience have not cultivated the observant faculty.

Usually, although not invariably, the diameter and thickness of metal in the riser increases progressively from the top of the casting upward, as shown in Fig. 115. The increased thickness of metal in the head imposes a contraction strain at the junction of the head with the casting and for that reason nearly every casting constitutes an individual problem.

Where this condition exists in exaggerated form, it is customary to set the casting to one side for a time after taking a roughing cut from the surface to be machined. The casting is allowed to stand, readjust itself and yield up all the strains before the final cut is taken.

Strains in the upper part of a casting, due to the difference in cooling time between two bodies of different thickness, can be prevented entirely or almost entirely, by breaking the continuity of the head as shown in Fig. 116. A number of prints—from two on small heads to six or even eight on exceptionally large heads—are spaced equidistantly while sweeping the mold, or, are attached to the pattern. Dry sand slab cores are inserted in these prints at the time the dried mold is assembled. These slabs or rectangular blocks divide the head metal into several sections. The value or feeding effect of the head metal is not reduced to any extent, but in the separated form, each section can cool and contract independently. In other words there is not the cumulative pull, present in a complete circle cooling as a unit.

On account of the greater cost of practically all other metals, the foregoing type of head is confined almost exclusively to gray iron and steel castings. Another factor which of course must be taken into account in this connection is that many of the heavy castings are made of cast iron or steel.

Use Reservoir Type

Under exceptional conditions a reservoir type of head, that is a head which serves both as a gate and feeder may be found advisable. This point was touched upon briefly in No. 2 of the present series and will be taken up again more in detail in a future installment dealing with gates for nonferrous metal, particularly statuary. For the moment it is sufficient to say that the metal first is poured into a reservoir provided with ball valve or stopper on top of the mold.

In some instances the nozzle and stopper head of steel foundry practice are employed. In others, the graphite stopper head is employed in connection with a dry sand core prop-

High Heads

THE pressure exerted by a high head, whether from the sprue alone, or, from the combination of sprue and riser, is an important factor in the production of clean, solid castings, free from shrinkage defects, cavities and porosity. In many instances a riser is of no benefit. On the contrary it represents a waste of metal and time. However, under certain conditions a riser becomes an absolute necessity and should be applied according to the dictates of common sense and experience. If necessary the bars in a cope should be arranged to permit placing the sprue and the riser in position to function properly. An interesting experiment among a group of foundrymen indicates that close care and attention to every detail is essential to the production of castings destined for severe service.

erly shaped to form a seat. In still other instances—and this applies particularly to gray iron foundry practice—a cast iron plug coated with blacking and dried, is employed instead of the graphite stopper head. Also, it is seated in a depression or tapered opening at the top of the sprue, formed directly in the sand of the cope or the bottom of the runner basin.

After the reservoir has served its purpose, either as a simple reservoir, or as a combined reservoir and feeder, that is after the gate or channel between riser and casting has solidified the remainder of the metal usually is tapped through a convenient hole in the side or end of the runner box. Occasionally this metal may be utilized directly for casting purpose, but in the majority of instances it is allowed to run into a pig bed where it can be handled more conveniently than if allowed to solidify in the reservoir.

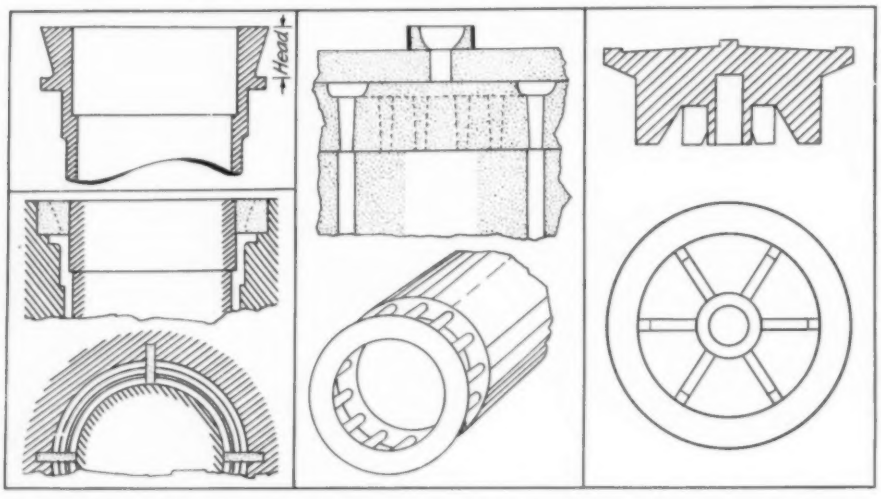


Fig. 115 *(Upper Left)—Common Type of Riser or Head on a Cylindrical Casting. Fig.* 116 *(Lower Left)—Top and Sectional Views Showing How Continuity of Head May Be Broken by Dry Sand Slab Cores. Fig.* 117 *(Center)—Type of Special Covered Runner Which Also Serves as a Riser and Feeder. Fig.* 118 *(Right)—Plan and Sectional View of Valve Casting Used in Contest*

The reservoir method presents many desirable features including a thorough mixing of the metal, opportunity for dross and occluded gas to rise to the surface and escape instead of entering the sprue, and last but not least, the pressure exerted upon the metal in the mold.

Metal Not Excessive

The type of head illustrated in Fig. 117 is used extensively on bushings and liners and may be adapted readily to suit variation in size. The amount of metal involved is not excessive. A covered runner is connected to the mold by a series of small pop gates. In some instances, castings of this kind are poured through a gate or gates at the bottom and in instances of that kind, the head simply serves as a feeder.

Before leaving this subject it may be pertinent to direct attention to the fact that a high pouring head usually is the only cure required for castings that persistently show shrinkage defects. Some castings require a riser or feeder in addition to the high head, but in a surprisingly large number of instances, a high pouring head will insure a solid, homogeneous casting without any additional manipulation. This is particularly noticeable in small and medium size castings where the action is rapid, where the metal passes from the liquid to the solid state in a period measured by seconds and where the static pressure resulting from the high pouring head is exerted in full force during this brief period.

Shrinkage in many cases is due to a short sighted policy which forces a molder to place the gate in an unfavorable position. On account of the size of the flask or the position of the bars he cannot place the gate stick to the best advantage, but must place it at some less desirable position. Thus in many instances it is placed close to a heavy section of the casting when theory, common sense and experience indicate that the metal should fill the mold in such a manner that the thinnest part receives the last metal.

Under ordinary conditions a large iron ball presents about as difficult a problem as a foundryman meets in his effort to produce a perfect casting. To produce a solid casting he must place a large riser or feeder on the mold and then keep a passage open in this riser with a rod, for the addition of hot metal. Removal of the riser from the casting involves additional labor and expense.

However, in many instances a perfectly solid casting is not required. Provided the outside shell is solid for a reasonable thickness, the utility of the casting is not affected if the interior is hollow. This feature is taken advantage of in the manufacture of many spherical iron castings and formerly was employed in the manufacture of cannon balls.

The flask is fitted with trunnions. Immediately after the mold is filled with metal, the small gate opening is stopped, usually by dashing water over it. The flask then is lifted and placed on parallel bearings where it is revolved on the trunnions until the metal in the casting has set. The constant motion prevents the metal from *drawing down* at any particular point on the circumference. The result is a casting apparently sound and solid all the way through. As a matter of fact it is sound and solid enough for all practical purposes. The shrink hole in the center, disclosed if the casting is broken, does not affect the usefulness of the casting.

Shrinkage manifests itself in various forms and places and up to the present no one has discovered a simple and easily applied remedy. Shrinkage may be caused by many factors, including the composition of the iron, the position and number of the gates, the temperature of the iron, the condition of the sand in the mold, and the design of the casting. A change in one or more of these factors usually will prevent a repetition of a particular shrinkage manifestation. For example instances are not unknown where the shrinkage defect has been banished by the simple expedient of pouring the iron at a lower temperature than usual.

Shrinkage defects invariably manifest themselves at the junction of light and heavy sections, due of course to the fact that the metal in the heavier section remains liquid for some time after the metal has solidified in the lighter section. By cooling the metal, by gating the casting at the thin part, by providing gates larger than usual to guard against possible missruns, a fair possibility exists that the rate of cooling in the thin and thick sections will be equalized to a considerable extent.

Reverse the Pattern

In some instances a reversal of the pattern in the mold will banish certain forms of shrinkage defect. In nearly every instance a pattern lends itself readily to molding with a certain face in the cope and a certain face in the drag. In other instances a pattern arbitrarily is molded in a certain position, because a perfectly clean face is essential on the side that is cast *down*. Of course many patterns are split into symmetrical halves and the molder is given no choice. Manifestly one half must go in the drag and the other half in the cope.

Out of the foregoing classification the only type susceptible to shrinkage curing treatment, is the type that for any reason formerly may have been

molded with the greater part in the cope. By reversing the position of the pattern, the greater part of the bulk remains in the drag and as a result the pouring head is higher in relation to the casting, than it was under former conditions.

Where local conditions prevent adoption of this plan—reversal of the pattern—practically the same effect may be obtained by raising the pouring head and riser, if a riser is needed. Risers at best are a necessary evil. They involve the cost of melting additional metal, the time of a man with a feeding rod and additional expense in the cleaning room. In many instances a little study and experiment on the part of the foundryman will reveal methods by which these undesirable features may be eliminated. A change in the design of the pattern, a changed position in the mold, a different type of gate, a higher pouring head, or a change in the composition on temperature of the metal, may accomplish the desired result.

Extent to which intangible factors enter into the production of castings was illustrated in an interesting manner a few years ago when a friendly contest was staged by the New England Foundrymen's association. A pattern of a rather complicated casting entering into the construction of a locomotive throttle valve was sent to five foundries with instructions to make a casting soft enough to machine readily, free from blowholes, impurities, shrinkage or contraction cracks and of a suitable structure to withstand super heated steam at a pressure of 500 pounds per square inch.

Three Were Condemned

The castings were cleaned and shipped to the plant where the inquiry originated. Here they were machined and then inspected by a committee which either passed or condemned each casting. Out of the five, only two were considered absolutely perfect. The remaining three would pass a casual inspection, but minor imperfections left the judges no choice but to reject them under the terms of the contest. The first casting showed a small shrinkage crack in the bore. The second had a small blowhole in the same location and the third showed a small shrinkage crack close to one of the ribs around the hub.

Of the perfect castings one was poured through a horn sprue while the other was poured through two diametrically opposed gates. However, in both instances the men who made these castings stressed the point that they had used *plenty of pressure*. The man who employed the two gates had 8 inches of sand over the top of the pattern. The horn gate man had placed chills between the ribs. The plain gate man used no chills, but he placed the mold on the table of a molding machine and kept a vibrator running until the metal solidified. Also he added about 1 ounce of lead to the metal in the ladle to increase the fluidity. With metal of the proper composition—silicon about 1.90 per cent—he claimed these precautions would not have been necessary. He had been forced to pour the casting from his regular mixture showing an approximate silicon content of 2.60 per cent.

This is the twenty-second of a series of articles dealing with the various types of gates and risers used in the foundry industry. The twenty-third installment will appear in an early issue. —THE EDITORS.

Utilize Pressure in Casting Brass

DIE casting by the pressure method will be more widely used in this country in the near future, according to present indications in the industry. Already it is being applied to brass die castings, two large brass companies having installed machines of the new type and two others being under contract for similar machines.

The Titan Metal Mfg. Co., Bellefonte, Pa., has installed three brass die casting machines of the pressure type, made by Josef Polak, Prague, Czechoslovakia. It is reported that seven more machines will be placed in the Titan plant later.

The American Brass Co., Waterbury, Conn. has purchased and placed in its Ansonia, Conn., plant two of the pressure brass die casting machines designed by Charles Pack, New York. The Doehler Die Casting Co., Batavia, N. Y., is now installing six casting machines of the pressure type, designed by the company's own engineers.

Exchange Departments

Recently, Doehler entered into an agreement with the Bohn Aluminum & Brass Corp., Detroit, whereby the former would take over the Bohn die casting department in exchange for the Doehler permanent mold department. At that time, Henry H. Doehler, president of the company which bears his name, issued the following statement:

"The transfer involves an exchange of the Doehler permanent mold castings department here (Batavia) for the die casting division of the Bohn Aluminum & Brass Corp., of Detroit. The change will result in adding 30 casting machines to the company's battery of 45 units at the Batavia plant.

"The die casting department being augmented at Batavia has enormous possibilities and should grow rapidly in the course of time."

The Kohler Co., Kohler, Wis., has installed a pressure casting machine of the Pack design in its plant. Other companies are reported in the field for the new style machines, and it is felt by those executives in whose plants the pressure machine is being installed that the entire die casting industry will be affected by the new method.

The foreign type of pressure die casting machine now becoming well known in this country is that perfected by Josef Polak, of Prague. It has been within only the last few months that this machine has been offered for sale in the United States. Its selling agents here state that 80 machines of that type are in successful operation in all the principal countries of Europe, including Russia and in Japan as well. Twenty machines are contracted for in this country.

Charles Pack, consulting engineer of New York, has placed on the market a machine which uses the pressure system. Mr. Pack predicts that the phrase *pressure casting*, will soon be recognized in the trade as describing a kind of product and process in contrast with the current term of *die casting*. In general, the main features claimed for the Pack machine are the same as those attributed to the Polak model. Similarly, the new Doehler casting machines function under pressure.

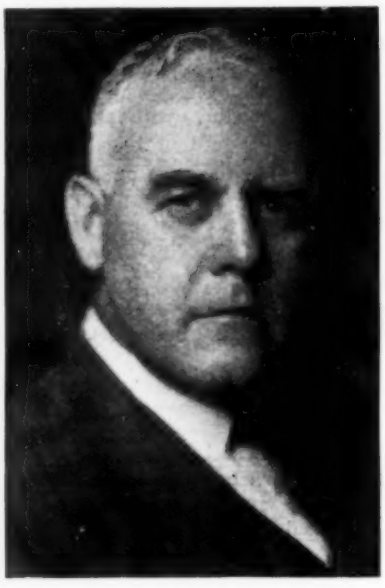
Reports on Corrosion

The American Society for Testing Materials, Philadelphia, recently has reprinted the report of its committee A-5 on corrosion of iron and steel. The report contains 67 pages giving data on total immersion tests of sheets in sea water and in acid; field tests of metallic coatings on hardware, structural shapes, conduit, etc., and the investigation of embrittlement. Foundrymen will be interested in the section on tests of metallic coatings which includes results of tests on electrogalvanized, hot-dip galvanized, cadmium plated, electric and gas-sherardized, parkerized, and hot-dipped aluminum coatings on malleable and gray cast iron.

Utley Views Industry's Future With Confidence

Tells National Founders That Stabilization of Customer Buying Is Necessary To Stabilize Employment

CONFIDENCE that the foundry industry will weather the present industrial storm in good shape, was expressed by S. Wells Utley, Detroit Steel Casting Co., De-



S. Wells Utley

troit, president of the National Founders' association, at the opening of the thirty-fifth annual convention of that group held at the Hotel Astor, New York, Nov. 18 and 19.

Mr. Utley believes that when a change for the better does come, it will come more suddenly and perhaps sooner than now generally is believed. He warned against panaceas. The great assets of this nation are not its raw materials nor its manufactured products, but the initiative, energy, self-reliance, character of its people and the greatest danger of these times is that through soft thinking, we shall adopt some things which appear to be cure-alls, but which actually weaken the mental qualities classified as industry's chief reliance.

Some of the fallacies which have arisen during the past two years, were mentioned. The greatest fallacy, he declared, is the belief that a corporation finally is responsible for the employment of men, or that it provides the money to fill the pay envelope. Always, and in every condition, it is a product which pays the wage. Slackening comes only when orders begin to drop. Under such conditions, the management of any corporation, no matter what its size and how great its assets, is powerless. It, like its employes, is out of a job.

Mr. Utley believes that it is impossible to stabilize employment until industry first has stabilized the customer's buying; a difficult task. Only by altering many characteristics of the average American can this be accomplished and if these characteristics are altered, so much would be taken away that what is left would not be worth preserving.

Hazards Uninsurable

Fallacies of general public unemployment insurance were outlined by Dr. F. Spencer Baldwin, director of research, National Industrial Conference board. He laid down certain definite conclusions regarding possibilities and limitations of insurance as applied to unemployment, based on a study of the problem by the conference board.

The hazard of unemployment largely is uninsurable, he declared. Insurance must be effected on a mathematical basis, but an analysis of the several types of unemployment discloses that, in general, conditions which determine them do not permit mathematical computation. Although unemployment cannot be dealt with on an insurance basis, it is possible to apply insurance principles to unemployment if the insurance plan is limited definitely in coverage and is held strictly within the limits laid down at the start.

Dr. Baldwin also concluded that while private unemployment insurance could be kept within the limits essential to successful operation, experience shows that this is not practicable in the case of a general plan of compulsory public unemployment insurance. Experiments with public unemployment insurance in other countries have demonstrated that, largely in consequence of the impossibility of keeping it within proper insurance limits, it is opened to serious objections. It tends to encourage idleness, and to restrict the mobility and adaptability of labor. Moreover, it offers no in-

Carl H. Hoffstetter

ducement to employers to take measures for the prevention of unemployment, but on the contrary it penalizes the employer who maintains a high average level of employment, since he is obliged to contribute more proportionately to the insurance fund. It bears unjustly on the industrious, regularly employed workers, who are compelled to contribute to the support of the unemployed.

Such insurance, it has been demonstrated, imposes a heavy burden of expense on industry and on the government; sets up a cumbrous and burdensome bureaucratic system; and destroys a growth of voluntary private unemployment benefit and insurance plans.

Another general observation as a result of the National Industrial Conference board's survey is that the development of private unemployment insurance plans represent at best only a partial solution of the problem of unemployment. Finally,

unemployment insurance is not applicable immediately as a remedy for the present unemployment emergency, which must therefore be met by relief measures, frankly recognized and represented as such and not camouflaged as insurance.

Opposes Insurance Plan

Proposals of general unemployment insurance also were attacked vigorously by James A. Emery, counsel, National Association of Manufacturers, Washington. They assume various forms but in essence they are one, he declared. They take the color of federal aid, through which the national government matches the states in establishing a fund from which a benefit is to be paid within the states; supervised and substantially dominated by a federal bureau.

Three steps appear in all the schemes, Mr. Emery declared, as follows: (1) Federal aid to the state by an appropriation; (2) which is dependent on accepting the approval of a federal bureaucrat as a condition for securing the federal aid when the state's plan conforms to the federal idea of what it ought to be, and (3) a supervision of the details of the plan in which both the state funds and the federal aid are expended as a condition of retaining the contribution from the federal treasury. All this, he declared, ultimately means not only a huge drain in the treasury but an exchange of all the essentials of local government for a federal contribution and the gradual breaking down of local control of policy. Once established in these fields, it is likely to be extended to others and the balance between national and local government is destroyed. The tendency developing, Mr. Emery said, is the more insidious because it is difficult, if not impossible, to test the validity of such appropriations in court.

Certain definite requirements must be met by management before educational and training programs for foremen and workers are undertaken, according to A. D. Lynch, director of personnel, Ohio Brass Co., Mansfield, O. These are: Proper working conditions; proper equipment, machinery, tools, materials; proper wages, equitably administered; continuity of employment; opportunity; proper leadership. These are the things that management either has provided or now is trying to provide. The result of this movement will be groups of workers, amenable to instruction and guidance.

Foremen in industry must be trained to interpret properly management policies, intents, purposes and needs to workers. This will require training of foremen. Definite policies for his guidance must be established and explained by management. He must know the product and its market, the problems of his management, and plans for these problems. He must know his costs and effect economies in operation. He must be trained to plan, instruct, supervise and execute; and, above all, he must possess qualities of leadership.

In the promotion of the association's program for industrial training, Mr. Lynch stressed the importance of repetition in the training of men. Often, he said, he is confronted with the question: We have laid down and explained our policies, what shall we do next?. In these cases he has told the respective managements to outline the policies again, possibly touching on them from a different angle, but to keep repeating them from time to time in

J. M. Taylor

group meetings to prevent misunderstanding. In effect, it is a mental drill which makes for greater perfection.

Proper instruction of foremen is essential in the succesful promotion of personnel work; and for the foremen to carry on properly, it is necessary that they not only know the technic of the work involved but that they understand the individual types of men working under them.

In the handling of employes, members were warned by Louis W. Olson, the Ohio Brass Co., Mansfield, O., and chairman of the association's committee on industrial education, not to measure results by the absence of outward manifestations of discontent, or assume favorable results simply because the intentions of the management were good, in having provided numerous conveniences and corporate contributions to the physical welfare of the men. He urged companies to be thorough in their training and not to become over confident that the existing policies are all that are necessary.

Indicative of what can be accomplished along lines of safety work, Mr. Olson reported that at his own plant during the past year, where from 640 to 700 men were employed, there was not a single lost-time accident. In the company's malleable foundry and including the galvanizing department, there has not been a lost-time accident in more than two years.

The committee's program of regional meetings during the past year met with good response, although some disappointment was expressed that there were not more managers or proprietors in attendance at the meetings.

With the coming of years, the trend will be increasingly toward fewer working hours and more leisure. This observation by Dr. Gerald Wendt, New York, was based not only on industrial developments elsewhere, but particularly on those on the field of synthetic articles. In this field, he said, production of imitation articles has far outrun in most instances the normal production or growth of the originals. Dr. Wendt outlined progress in the manufacture of synthetic articles, mentioning coal, wood and oil as the principal base materials.

Relations of the forthcoming Congress to social and economic questions were discussed by James A. Emery, Washington, at the opening of the Wednesday afternoon session. According to Mr. Emery's observation, unprecedented pressure for measures requiring appropriations will be met by an equally strong public resistance against increased taxation; and with neither party having a strong enough representation to settle matters on party lines. Public, enforced unemployment insurance was stated by the speaker to be an impossible attainment due to the inability to estimate the risks from an actuarial standpoint and the difficulty of any sort of efficient administration. However, demand for public unemployment insurance undoubtedly will be made and as pointed out by Mr. Emery, a centralized government bureau for this purpose might be established with powers to expend staggering sums on what would amount to relief administration under the misnomer of insurance, and with no legal measure of protection available to the tax paying public.

Confidence Is Returning

Marc A. Rose, *The Business Week*, speaking on business conditions stated that confidence is returning, basic markets are strengthening and a better tone is apparent, although it is not yet reflected in statistics. Mr. Rose traced the history and causes of the depression and explained how the curves representing industrial commodities do not yet show an upturn, due in large measure to the in-

(*Continued on Page* 60)

Constructive Testing
Is An Aid to Designers of Castings

By F. C. Edwards

CONSTRUCTIVE testing is a distinct aid to the designer for with that tool, he is enabled to gage the relative strengths of various forms. He proves that certain types of design give appreciably higher ratios of efficiency, weight for weight, than others; that in some circumstances, the addition of metal actually weakens rather than strengthens a casting; and conversely, that the judicious removal of metal may confer extra strength. Thus, he is in a position to make the most effective use of the metal he employs, to achieve lightness, neatness and reliability.

Girder Sections Compared

Recently a designer desired to obtain comparative data on gray iron girder sections. Four patterns, shown respectively, at *A*, *B*, *C*, *D*, Fig. 3, were employed. Two castings were made from each, all poured from the same ladle. The bars were 14 inches long and were tested transversely on knife-edge bearings, 12 inches apart. The load was applied at the center of the bar in the direction of the arrows seen in Fig. 3. Bars *A* were of a plain rectangular section, 2 x 1 inch. Each casting weighed 7 pounds, 14 ounces. The first bar fractured under a load of 8960 pounds and the second at 9878.4 pounds. Bars *B* were of similar overall dimensions, but were channeled out from each side, leaving a central web ¼-inch, with ¼-inch flanges top and bottom. Each of these bars weighed 3 pounds, 6 ounces. One bar fractured under a load of 7840 pounds and the other fractured at 7638.4 pounds. Bars *C* were identical in depth with the previous ones, but the tension or lower flange was increased to 1½ inches in width, and the compression member or top of the section, was reduced to ½-inch in width. These bars were thus of the same weight as the previous pair, *B*, namely, 3 pounds, 6 ounces. As was to be expected from the wider tension flange, these bars gave higher stress values. One bar fractured at 8310 pounds and the other at 8646.4 pounds. Bars *D* were increased in depth to 2½ inches. The tension flange was reduced to 1-inch in width, and the compression flange was made ½-inch in width. Here, again, the weight of each bar was 3 pounds, 6 ounces. The tests resulted in fractures at 8479.6 pounds and 8512 pounds respectively.

Redesigns Casting

CONSTRUCTIVE testing is of importance to the designer of castings since, through that method it is possible to definitely determine the strength that may be expected from a certain design and if necessary redesign the casting to give the required strength. In this article, which is abstracted from a paper presented at a meeting of the Institute of British Foundrymen at Derby, England, the author gives results obtained from tests which show that the addition of weight to a casting does not always increase the strength but often tends to reduce that property.

Efficiency Increased

The principal feature of those tests is the increased efficiency of the channel-section bars over the solid rectangular bar. With a weight of but 3 pounds, 6 ounces, bars *B*, *C* and *D* each supported practically the same load as bars *A*, the weight of which was 7 pounds, 14 ounces each. This means that a service load of, say, 1120 pounds could be carried as safely by the channelled girders as by those of the solid, rectangular section, with less than one-half the expenditure of metal. Also, channelled girders, being more immune from the possibility of porosity, etc., than the rectangular girders, could be relied upon

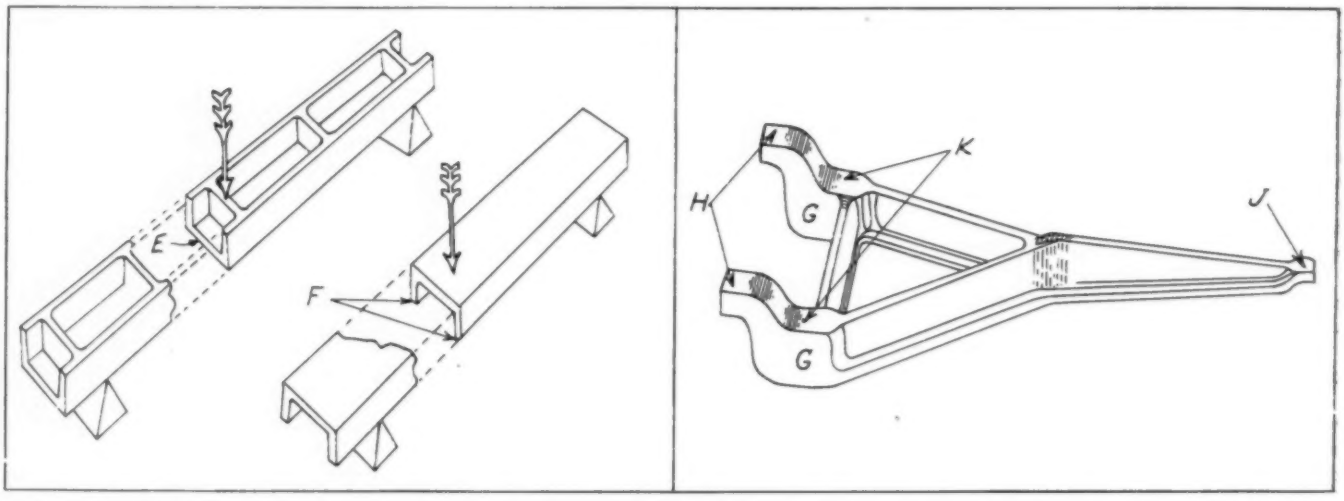


Fig. 1—Tests Conducted on Box Type Girders Showed that Approximately Twice the Load Possible with the Open-ribbed Side in Tension Will Be Carried with the Plate Side in Tension. Fig. 2—This Casting Was Redesigned and Made Stronger with 168 Pounds Less of Metal

more implicitly. Advantage gained by the lightened sections is due to the removal of metal from the neutral axis of the beams in *B*, *C* and *D;* to the transference of metal in bars *C*, from the compression to the tension side of the girder; and to the deepening of the beam in the case of *D* by transferring metal from the compression flange to the overall depth. In addition, some of the advantage gained is ascribable to metallurgical causes. These will be dealt with later.

Another significant feature of the tests is the great disparity in the results of the rectangular-bar tests as compared with the slight differences in those of the lightened sections. Thus, the difference between the respective breaking loads

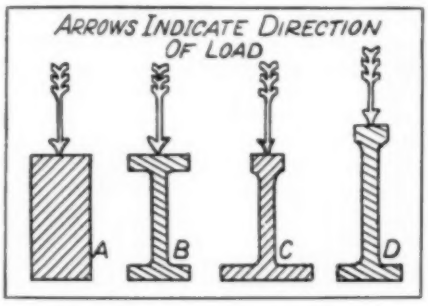


Fig. 3—Various Type Girders Tested

of the rectangular bars is 918.4 pounds against differences in the channelled sections of 201.6 pounds for bars *B;* 336 pounds for bars *C;* and 22.4 pounds for bars *D*. The infinitesimal disparity in the results of the channelled bars seems to imply greater dependability, because of greater consistency in these bars as compared with the difference shown by the solid bars.

Other tests were carried out on miniature box girders, shown in Fig 1, to determine the relationship between the strength of this type of component with the load applied, with the plated side in tension and with the open, ribbed side in tension. The specimens were 14 inches long, 1⅛ inches wide, and ⅝-inch deep. The metal was of a uniform ⅛-inch section. These bars, again, were tested on 12-inch centers. Two castings first were tested with the plate side in tension, as at *E*, Fig. 1, where the arrow indicates direction of load. One fractured at 952 pounds with a deflection of 0.096-inch. The other fractured at 728 pounds with a deflection of 0.157-inch. The next pair were tested with the ribs in tension, as at *F*, Fig. 2. The first specimen fractured at 410 pounds, with a deflection of 0.08-inch. The other fractured at 448 pounds, with a deflection of 0.068-inch.

Carries Twice the Load

From these tests we learn that a similarly proportioned girder may be expected to carry approximately twice the load with the plate side in tension as would be possible with the open-ribbed side in tension, so that if, say, a frame casting was designed to carry inside mechanism and to withstand outside pressure of surrounding earth, subjected to heavy traffic, for example, more economic design may be secured by arranging the frame with the ribs on the outside. In this way, the tensional stress would be distributed over the full width of the plate, and the ribs merely would be required to serve as compression members.

Previously, it was stated that the superiority of the channelled girder over that of solid section was attributable partly to metallurgical causes. Removal of metal from the neutral axis of the component which caused a speeding up of the rate of cooling, as well as promoting a more uniform cooling rate throughout the casting as a whole, gave a higher stress value, weight for weight, than possibly could be obtained with the rectangular section.

This influence of the rate of cooling on cast metals is generally known, but it is not realized so generally that different mixtures of gray iron, for instance, cannot be relied upon to give correspondingly parallel stress values for respectively identical differences of section. Two mixtures, differing from each other in analysis,

Table I

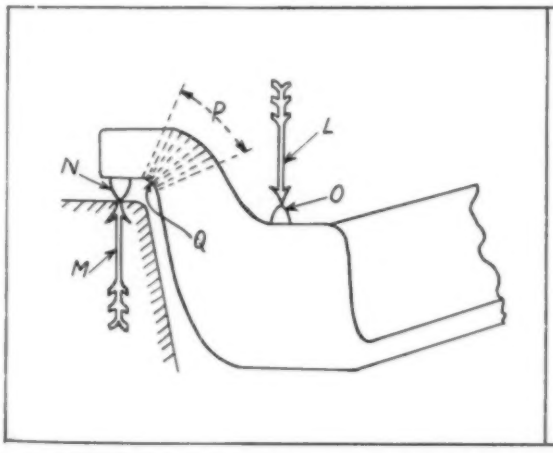
Mixtures Used

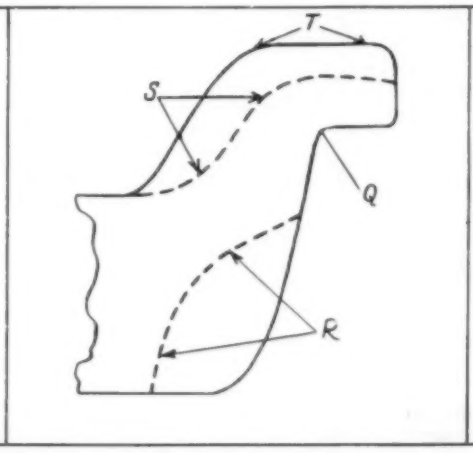
Element	Light, General Mixture Per Cent	Semisteel Mixture Per Cent
Silicon	3.3	2.0
Sulphur	0.08	0.1
Phosphorus	1.10	1.0
Manganese	0.5	0.5
Graphitic Carbon	3.5	3.0
Combined Carbon	0.18	0.45

Analyses given are the average of tests taken from 2 x 1 inch bars.

and cast in circular section bars of ¼-square inch sectional area may be found to be practically identical in tensile strength. The same mixtures when cast in circular bars of 1 square inch sectional area, may exhibit a difference of 20 per cent in tensile strength and further changes in tensile-stress value may be found by varying the form of the bar section.

It may be of interest to refer to a series of tests carried out on circular and rectangular-section bars in different mixtures of gray iron. Tensile test bars, 12 inches long, were cast in two forms circular and rectangular. The rectangular bars were ⅛ x 2 inches; ¼ x 2 inches, and ½ x 2 inches. These give sectional areas of ¼ square inch; ½ square inch; and 1 square inch respectively. The circular bars were cast as near as possible to the dimensions which correspond to the areas of the rectangular bars, namely 0.564-inch diameter for the ¼-square inch bar; 0.798-inch diameter for the ½-square inch bar, and 1.132 inches diameter for the 1 square inch bar. Both types of bar were cast in two different mixtures—





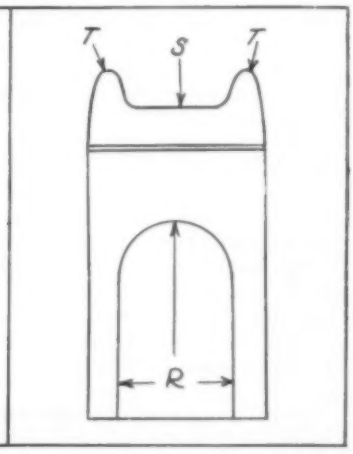


Fig. 4—The Forces M and L Act at Points N and O Causing Rupture in the Section P. Fig. 5.—Side View in the Redesigned Foot . Fig. 6—End View of Redesigned Foot Also Showing Lightened Undersection

one, suitable for light, general work, and the other with a 10 per cent steel admixture. Analyses of those mixtures are given in Table I. Three bars of each size and composition were cast,

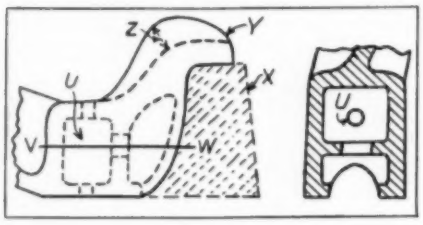


Fig. 7—Method Used to Core Out the Foot

and the average results of the tests are given in Table II.

From a comparison of the figures in Table II, it will be seen that the rectangular-section bars give higher values unit for unit, than those of circular cross section. The difference becomes increasingly pronounced as the sectional area is reduced. In the large section, a difference of 2240 pounds per square inch is shown. When the small sections are compared, a difference in their respective breaking loads of 8960 pounds per square inch is found.

Tensile Strength Differs

If results of the tests are compared on the mixture basis, a difference of tensile strength value operating in the opposite direction is found. In both circular and rectangular bars, the large sections show a difference in the tensile strength of the two mixtures of 6720 pounds per square inch to the advantage of the semisteel. In the small sections, on the other hand, the difference per square inch is seen to be 1680 pounds for the circular bars, and 2800 pounds for the rectangular bars.

The above differences are attributable to the effect of the varying rates of cooling on the different sections and mixtures. Each successive diminution of section is accompanied by a corresponding acceleration of cooling rate, which tends to produce a finer grain structure. The rectangular bars owe their marked superiority of tensile strength over the circular bars to their higher cooling rate, and to the more uniform effect of such cooling throughout their cross-sectional plane.

Here, the time element is the determining factor, with a cross-sectional area of ¼-square inch the ⅛ x 2 inch rectangular bar has a perimeter of 4¼ inches, the same cross-sectional area in the 0.564-inch diameter circular bar has a perimeter of but 1.77 inches. And the distance from the perimeter to the center of the rectangular bar is but one-fourth that of the circular bar.

Under similar mold conditions, this implies a corresponding difference in the respective radiative powers of the two bars. The metal in the rectangular bar passes through the successive stages of cooling in a shorter space of time than that occupied by the metal in the circular bar. It logically follows that as the operation of cooling attains a higher degree of simultaneity in all parts of the rectangular bar, the final structure of the metal achieves a correspondingly enhanced measure of homogeneity.

Cites An Example

An actual case in which constructive testing, by demonstrating the superiority of certain features, not only secured a stronger casting, but also effected a material saving of metal is the casting for a triangular lever used in a road weighbridge and shown in Fig. 2. Previous to the change in design those castings, subjected in service to severe shock stress, occasionally gave way. Since redesigning there has been no record of a single casting being fractured either in transport or in service.

It is important to note that the shock stress to which these levers are likely to be subjected in service is largely concentrated on what are termed the *feet*, *G* in Fig 2. An enlarged sketch of one of these feet is shown in Fig. 4. As a first step, helpful in constructive testing, consider the direction and approximately relative intensity of the stresses to be carried. The casting, in service, is suspended at the extreme centers, *H* and *J*, on suitable knife-edge bearings. Load is applied at *K*, Fig. 2. Since the distance between the centers *J* and *K* is about 10 times that between *H* and *K*, the stress at *J* is but one-tenth that operating at *H*. Therefore, compared with the load on the feet, the stress at the *nose end* of the casting, *J*, safely may be ignored.

Stresses on the feet, operate in the direction of the arrows *L* and *M*, Fig. 4. With the end of the lever resting on knife-edge bearing *N*, as the fulcrum and the load on bearing *O*, it is easy to imagine that the casting would be most likely to fracture somewhere between the limits indicated by the arrow *P*, commencing at the corner *Q*, which we may term the *tension flange*. Preceding rupture, the metal at the outer surface *P* would thus be in compression. Practice supports this theory and fracture invariably occurs on the lines as indicated.

It should be observed that the feet as originally designed, were cast solid, as shown in Figs. 2 and 4. Dimensions were found by computing the stresses under which it was assumed the casting would operate, and by the application of a safety factor assuming a certain minimum strength for the metal.

Keeping in mind the previously mentioned simple experiments, a material increase in the strength of this casting may be secured by the removal of surplus metal, especially from the compression side of the foot. Since cast iron is considerably stronger in compression than in tension, the metal on the compression side of the foot in excess of what is necessary for the support of the casting before rupture occurs at the tension flange, is not only wasted, but, by slowing up the general rate of cooling, definitely militates against the strength of the casting along the line of incipient rupture at the corner *Q*.

Two Specimens Compared

Such reasoning indicated a provisional line of action to be pursued in the constructive testing. To obtain comparative data, two half-size models of the feet were made, one solid and the other lightened, as shown at *R* and *S*, Figs. 5 and 6, which represent side and end views respectively of the feet. Castings were made under the same molding conditions and poured from the same ladle. The castings were tested to breaking point, the load being applied in a similar man-

Table II

Test Results from Various Bars

Circular Bars

Section Dimensions	Area Square Inches	Composition	Breaking Load Pounds	Load Per Square Inch, Pounds
0.564 Inches Dia.	¼	General	8,960	35,840
		Semisteel	9,363.2	37,452.8
0.798 Inches Dia.	½	General	15,904	31,808
		Semisteel	18,592	37,184
1.132 Inches Dia.	1	General	26,992	26,992
		Semisteel	33,600	33,600

Rectangular Bars

⅛ x 2 Inches	¼	General	11,200	44,800
		Semisteel	11,894.4	47,577.6
¼ x 2 Inches	½	General	16,889.6	33,779.2
		Semisteel	21,616	43,232
½ x 2 Inches	1	General	29,120	29,120
		Semisteel	35,840	35,840

ner to that to which the actual castings are subjected in service. The solid foot gave way under a load of 21,056 pounds and the lightened casting broke at 25,312 pounds.

Rupture undoubtedly starts at the corner *Q*. The outer flanges, *T*, are thus merely compression members and this outer surface, although materially relieved, is still far less likely to yield under a compressive stress than the inner surface at *Q* under a tensile stress. Even though metallurgical considerations are neglected, the removal of the metal does not militate against the strength of the foot. Regarded from a metallurgical point of view, an appreciable increase in strength is expected in the lighter section. The simple tests mentioned in the fore part of the article proved that the strength of a casting per unit area decreases with increase of section. The variation is a function of the rate of cooling. In this case, the removal of excess metal from the compression side of the foot, in addition to lightening the body at *R*, actually confers more than 20 per cent increase of strength upon *Q* by speeding up general cooling.

Redesign Saves Metal

After constructive testing had resulted in a more efficient form of foot, the feet of the working lever pattern were modified correspondingly. In addition, the body of the foot was cored out as shown at *U*, Fig. 7. Finally, to reduce still further the risk of failure of the casting in service, one of the feet of an actual working lever was tested well beyond the recognized safety-factor limit. The maximum test load for this particular capacity lever is 44,800 pounds. When 60,480 pounds had been registered without any sign of fracture, the test was discontinued. The lever was subsequently passed into service.

It should here be noted that the gain both in efficiency and reliability of the modified component was not accompanied by any increase of molding cost. The top recess *S* was carved out of the pattern. The front recess at *R*, Figs. 5 and 6, was obtained by a modification of the existing breast corebox, the coreprint for which is seen in dotted section at *X*, Fig. 7. The internal core *U*, was obtained likewise by converting the existing straight-core corebox into one of the bottle neck variety.

The peculiar shape of the top of the foot in Fig. 7 compared with that of its predecessors in Figs. 3, 4, and 5 marks a further advance in the evolution of these lever feet. By transferring metal from the lesser-stressed portion at *Y* to the greater-stressed section at *Z*, the foot is enabled to withstand the combined bending and tension stress of service loads better. The weight of the metal saved amounted to 84 pounds on each foot or 168 pounds per casting.

Index Simplifies Pattern Storage

THE card 3 x 5 inches shown in the accompanying illustration is used at the plant of the Atkinson Co., Rochester, N. Y., to give complete information about the pattern of any customer. Under this system it is claimed that no pattern can be lost. Also it supplies a complete history of the castings made in a convenient form for ready reference.

A new pattern is assigned a shop number, written in the upper left corner. The card is filed under this system of numbers which runs consecutively. The name of the customer, weight of the casting, and metal mixture are entered in columns provided for the purpose. The type of casting is listed in the *description* column. Material in the pattern, wood, brass, white metal, etc., and whether loose pattern or matchplate, are entered in the *patterns* column. Other lines are provided in which to enter particulars of loose pieces, number of coreboxes and other related information.

Pattern storage department contains a series of shelves divided into sections and numbered. Space for information covering the rack, the shelf and the particular section of the shelf, is provided near the bottom of the card. Two columns at the right end of the card are reserved for dates on which the pattern either entered or left the foundry. When the pattern is received at the foundry the date is entered in the first column. When, for any reason, changes, repairs, etc., the pattern is taken away by the customer, the date is entered in the second or outside column. When an inquiry is made, the foundryman at a glance can tell whether the pattern is in his or in the customer's possession.

Three sections, each subdivided into three columns on the opposite side of the card are headed *Date*, *Quantity* and *In*. When castings are made from a given pattern, the date and the quantity are marked in the respective columns. When the pattern is restored to the pattern storage a check mark is placed in the column marked *In*, to indicate that the order has been filled. A glance at the card shows the location of the pattern. A check mark following the latest entry in the date and quantity line indicates that the pattern is in the storage. Absence of a check mark shows that the pattern is in the foundry.

Unfilled orders of brass and bronze ingots and billets of members of the Nonferrous Ingot Metal institute, Chicago, totaled 20,968 tons on Nov. 1, compared with 20,073 tons on Oct. 1.

NO.	NAME	WT.
	MIX. NO.	
DESCRIPTION	REC'D	RET'D
PATTERNS		
LOOSE PCS.		
CORE BOXES		
LOOSE PCS.		
RACK		
SHELF SECTION		
(OVER)		

DATE	QUAN.	IN.	DATE	QUAN.	IN.	DATE	QUAN.	IN.

(Left)—Information on the Pattern and Its Location Are shown on the Front of the Card. (Right)—The Reverse Side Shows the Date Used, Quantity of Casting Made and Whether or Not the Order Has Been Filled

Reduce Accidents By Using Protectice Devices

By Seymour W. Doran

IN MANY foundry operations it is impractical, owing to the nature of the operation, for the workers to protect the hands with gloves. Numerous operations are such that the work could not be done satisfactorily if gloves were worn. Particular reference is made to core makers, molders, and core setters. However, in every operation where possible, the workman should wear gloves. Flask handlers and chainmen, two foundry groups to which hand injuries most frequently occur, always should wear gloves. All small flasks should be made so that pins can be inserted readily in either side for easy lifting. All heavy flasks should be constructed with proper handles for use of chain hooks. All pourers and helpers should wear gloves to prevent burns from splashing metal.

Signals Should Be Used

A simple, effective system of signals should be used for handling materials in the foundry. To be effective, there must be a clear understanding of the responsibility of both the chainmen and the crane operator with reference to those signals. No movement of the crane must be allowed without a signal from below. In addition, the crane operator must be given authority to refuse to move his crane if, in his opinion, to do so would endanger the chainman or others. Such signals should be uniform throughout the plant.

A greater number of hand injuries occur in the finishing department than in the foundry. In that department the same hazards are present which exist in the foundry and in addition, hazards from chipping, grinding, and handling. Chippers cut their hands against sharp fins and frequently jam fingers or hands between two castings when turning them over. Grinders often get bad burns from getting their hands in contact with wheels. In all of these operations the wearing of gloves is the only practical protection available.

Pratt & Letchworth Co., Buffalo, N. Y., for the past four years has not allowed anyone to start to work unless he is equipped with a pair of standard safety shoes in good condition. A large percentage of the product of that company is steel castings ranging from 12 to 180 pounds. Output is on a production basis and requires considerable handling by hand. Up to four years ago, the largest single cause of lost time accidents was due to castings falling on workmen's feet. It became so serious that it was decided to make an effort to have men wear safety shoes. The company put in a large stock of shoes and by group talks, bulletins, safety committees, etc., tried to induce the men to purchase and wear the shoes. Efforts met with little success and accidents kept piling up. The executives of the company were convinced that if the use of shoes was made general, there would be a decided reduction in accidents caused from falling objects.

The conclusion finally was reached that the adoption of safety shoes was the only remedy for foot accidents and bulletins were posted to the effect that on or before a certain date every man, including the general manager, was expected to be equipped with safety shoes. The foremen were called into conference and were instructed to see that the order was carried out. No special time for payment or any special sum per week was set and the company accepted as low as 25 cents per week in some cases. Shoes are sold at cost. A record was kept of those cases where it was obvious that a shoe prevented an accident or had been the means of reducing what otherwise would have been a serious injury. The cases were so numerous that they proved not only to the company, but to the men that the wearing of safety shoes was a practice which worked out to their mutual advantage.

Goggles and Gloves in Use, but Leggings, an Essential for Safety, Missing

While it is true a shoe with a good stiff toe-cap will protect the instep to a large extent by breaking the fall of the object, the object does not always strike that part of the shoe. What causes objects to fall? Investigations of accidents showed a large percentage were from faulty hooking. Many other accidents were caused through careless piling, both on lift trucks and stock piles. An intensive educational campaign, designed to teach our chainmen, handlers and hookers the proper method of hooking castings or loads was started.

The most frequent foot accidents were caused by smaller castings falling off benches, particularly during inspection. That was cured by building up the edge of inspection benches. A strip four to six inches wide and two inches high at outside and tapering to nothing at the top of bench was added.

Protects the Eyes

The only adequate eye protection is one of the standard grades of goggles, spectacles, colored or white. Heat pourers and those helpers who attend the ladle when heats are poured, should wear spectacles with a No. 2 shade green lens. The lenses should be extra large. The wearing of spectacles on this job is not only to protect the men's eyes from the glare of the metal but also to protect the eyes in the event a mold explodes.

Aside from these two operations, there is little need for the use of goggles in the foundry proper. The cleaning room presents an entirely different situation. Up to approximately nine years ago, most companies encountered considerable difficulty in having the chippers and others in the finishing departments use eye protection. Those days are past. The principal danger is in too lax enforcement

of the goggles rule. No one should be permitted under any circumstances to step within the confines of a cleaning department unless his eyes are protected with goggles.

Eye injuries in grinding operations have been to a large extent eliminated due to improved guarding. This is evidenced by the fact replacement of lenses for grinders' goggles has been reduced at least 50 per cent. In acetylene welding operations there was great danger of eye injuries due to the old practice of preparing the work without first replacing the welder's goggles with a toughened chipper's goggle. The old practice was to shove the welder's goggles up on the forehead or the cap and clean the castings preparatory to welding. That practice has been overcome by requiring welders to prepare two or three hours' work before doing any welding. Since that practice was inaugurated, that department has not had a single eye injury.

Proper Protection

A WIDE variety of safety equipment has been developed to protect workers in industry. In the foundry, such protective devices as gloves, shoes, goggles, leggings, wheel guards, etc., may be secured to materially assist in the reduction of waste through industrial accidents. At the plant of the Pratt & Letchworth Co., Buffalo, where the author is superintendent, the adoption and compulsory wearing of safety shoes practically eliminated a troublesome epidemic of foot injuries. The article is abstracted from a paper presented at a Pittsburgh meeting of the National Safety council.

WashingtonGroupMeets

Thirty foundrymen from Seattle, Tacoma and Everett attended the dinner meeting of the Washington Foundrymen's club at the Exeter hotel on Thursday, Oct. 29. A feature of the meeting was a talk on "The Economic Effect of the Suspension of the Gold Standard" by Dr. Howard Hall Preston, school of business administration, University of Washington, Seattle. Dr. Preston long has been a student of subjects affecting the value of mediums of exchange, and those in attendance secured a much clearer understanding of the gold standard and how local imports and exports are affected by a change in the standard.

Members then discussed various problems on foundry practice. It was a consensus of opinion that a substantial pick-up of foundry operations in the Washington district will develop after the first of the year.

Relay Old Iron Pipe

During the fiftieth annual convention of the New England Water Works association recently, a section of the original cast iron pipe, that was laid in 1848 to bring water to Boston, was excavated for inspection by the convention visitors. Mayor Curley officiated in the exercises which were held on Boston common. Before making his address of welcome to the delegates, the mayor threw a shovelfull of earth over the pipe, which is still in perfect working condition, to symbolize its continuation in the service of the city. The shovel wielded by Mayor Curley was the same implement that Mayor Josiah Quincy, and former President John Quincy Adams, used in breaking ground in Wayland, Aug. 20, 1846 when work on the Cochituate aqueduct was begun. According to records of the original ceremony, the spade was manufactured by O. Ames & Sons, Easton and recently has been kept in the Boston Historical society's collection at the Old State house.

Chicago Foundrymen Discuss Cores

Phases of core making and analysis of core binders were discussed at a meeting of the Chicago Foundrymen's club, at the City club, Chicago, on Nov. 5, by J. A. Gitzen, Lindsay-McMillan Co., Milwaukee. This was followed by a general discussion on core binders and core making practice. Mr. Gitzen discussed factors of core making, including sands, ovens, core moisture, plasticity of cores and core washes. He emphasized the importance of the oven in making good cores, with the proper regulation of oxygen, and uniform heat. It was stated that cores can be made with as much as 10 per cent moisture, although sticky core boxes result.

In speaking on core binders, Mr. Gitzen followed a number of points brought out in his paper on core binders at the 1930 convention of the American Foundrymen's association. Discussing core binders, the speaker outlined points of advantage of oil binders, cereal binders, rosin, paper mill by-products, pitches and corn starches. Mr. Gitzen gave a demonstration on how to calculate various core binder specifications for given formulas. He used the Crosby specifications and others to obtain basic formulas in illustrating that the proper writing of specifications for core binders usually gets results from the manufacturers, similar to the specifications for pig iron that result in shipment of the proper grades. The specifications covered specific gravity, flash, fire, iodine number, viscosity, saponification number, acid number and ash. He showed how to check against specifications with different formulas and pointed out that it is more economical to buy on specifications. The general discussion centered on analyses of core binders, the humidity factor in tensile strength of cores, ideal mulling time, and other factors.

The Chicago Foundrymen's club will hear an address at the December meeting on Thursday, Dec. 3, by H. J. Rowe, Aluminum Co. of America, Cleveland, on experimental casting work being conducted by that company.

Makes Electric Stoves

At a recent industrial exhibition held in Brisbane, Australia, a great deal of attention was attracted by several types of electric stoves shown by the Crown Stove & Foundry Co. This company first started operation in Brisbane in 1912 and rapidly forged to the front rank of stove manufacturers in the production of wood fuel and gas burning stoves for all purposes. Credit for the design and construction of the new electric stove is awarded to Ernest A. Knoblauch, mechanical superintendent of the company, who has had the project in hand for several years. Production of this new line of stoves at this time and featuring them at a great exhibition constitute a significant gesture of confidence in the future of Queensland and other sections of Australia, the principal market for the products of the Crown Stove and Foundry Co.

Book Review

A. S. T. M. Tentative Standards 1931, paper or cloth, 1008 pages, 6 x 9 inches, published by the American Society for Testing Materials, Philadelphia, and supplied by THE FOUNDRY, Cleveland, for $7 in paper and $8 in cloth, and in London by the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster.

Each year the American Society for Testing Materials publishes all the tentative specifications, methods of test, definitions of terms, and recommended practices in effect during that year. The term *tentative* is applied to a proposed standard which is published for one or more years to elicit criticism, before formal adoption as a standard. The present volume contains the tentative standards in effect as of September, 1931, and it is complementary to the 1931 *Book of A. S. T. M. Standards*, and its supplements. It contains 180 specifications relating to ferrous and nonferrous metals; cement, lime, gypsum, concrete and clay products; and miscellaneous materials.

Twenty-five specifications are listed under ferrous materials and include

track spikes, cold rolled strip steel, normalized and tempered alloy steel forgings for locomotives, electric cast-steel, stud-link anchor chain, austenitic manganese steel castings, etc. Under nonferrous materials 19 specifications are listed and these include fire refined copper other than lake; magnesium-base alloy castings; sand castings of the alloy 80 per cent copper. 10 per cent tin, and 10 per cent lead; seamless copper tubing bright annealed; nickel-chromium alloys for electrical heating elements, aluminum and zinc-base alloy die castings; etc.

Portland cement bricks and refractories, concrete pipe and hollow tile specifications and testing are included under cement, lime, gypsum, etc. Miscellaneous materials specifications relate to vegetable oils, petroleum, acetone, acetates, alcohols, road materials, coke, shipping containers, textile fabrics, rubber products, etc.

Steel Castings Meet Requirements

CASTINGS to withstand pressure must be free from internal defects, and made from dense homogeneous metal, which means that careful metallurgical and molding practice must be observed in their production. Frequently special heat treatment is necessary to give desirable physical properties to meet service requirements. Usually the castings must be readily machinable so that pressure-tight joints may be effected. All of those factors have been studied constantly by steel foundries specializing in that class of work. Advancement of that industry has been rapid due to the application of scientific control which today is practiced in almost every production operation. Such control is necessary to insure high-quality, dependable steel castings for high temperature or high pressure work, or both.

Soundness, density, and strength in steel castings is influenced by the deoxidation of the molten metal, and foundrymen to a large degree have mastered the technique of producing steel in a quiescent state free from occluded gases. Molding practice has kept pace with other developments through frequent investigations to determine the proper procedure. That is accomplished by dissecting sample castings by sawing or fracturing under heavy drop hammers.

More recently x-ray inspection has been utilized to study metal structures resulting from various methods of heading and gating. Thus the principles of proper design and molding technique have been worked out until at present the steel founder has at his disposal, a vast accumulation of practical scientific formulas to guide in the manufacture of a satisfactory product.

It often has been stated that castings can be only as good as the patterns from which they are made. Due to the foundryman's knowledge of the various factors involved in the production of good castings, it often is wise to leave the construction of pattern equipment in his hands, or to obtain his suggestions as to the proper method of construction. Knowledge of the service requirements to be met affords the opportunity for suggesting whether a plain carbon or an alloy steel, and the particular type of steel, will render the greatest service. That knowledge also enables him to suggest changes in design which are advantageous to the customer. Thus it may be seen that co-operation between customer and foundryman are highly desirable.

Research in steel castings production has made available a wide range of alloy steels and special heat treatments. Castings are made in steel of hundreds of different analyses, each of which possesses characteristics of which fit it for use in meeting specific service conditions. In addition, a wide variety of heat treatments can be used to control the grain structure of the metal to give it maximum utility for the purpose for which it is intended. Metal analysis and heat treatment control brinell hardness, which is an important factor in the machinability of a casting.

Each new job coming to the steel foundry receives special study, often by a group of experienced engineers appointed for this work. The task is engineered so as to insure satisfactory performance.

Many pressure castings are used in the modern power generating plant and for these applications the high temperatures encountered make the problem a dual one. Steel which will successfully withstand high pressures does not necessarily stand up well at elevated temperatures. Steel castings of certain analyses, how-

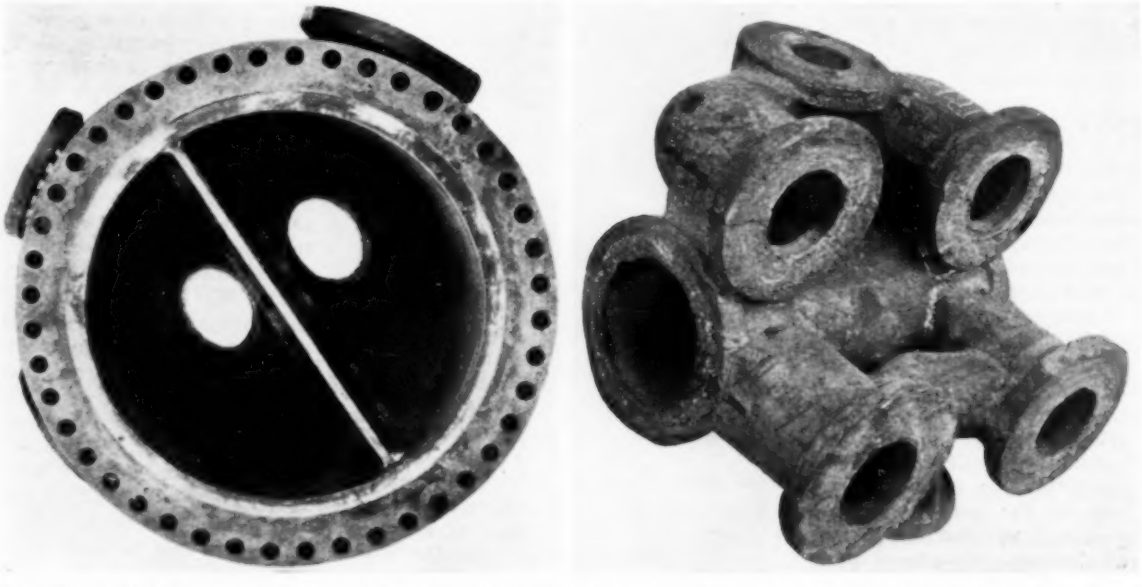


Fig. 1—A 21,000- pound Desuperheater Header Which Successfully Passed a Hydrostatic Pressure Requirement of 1000 Pounds Per Square Inch. Fig. 2—A Typical Steel Casting for Oil Refining Operations Which Handles Oil at 1200 Pounds Per Square Inch Pressure and at 900 Degrees Fahr.

ever, have been found to meet these conditions successfully. Fig. 1 shows a cast-steel desuperheater header in use at the new generating plant of the Brooklyn Edison Co., Brooklyn, N. Y.

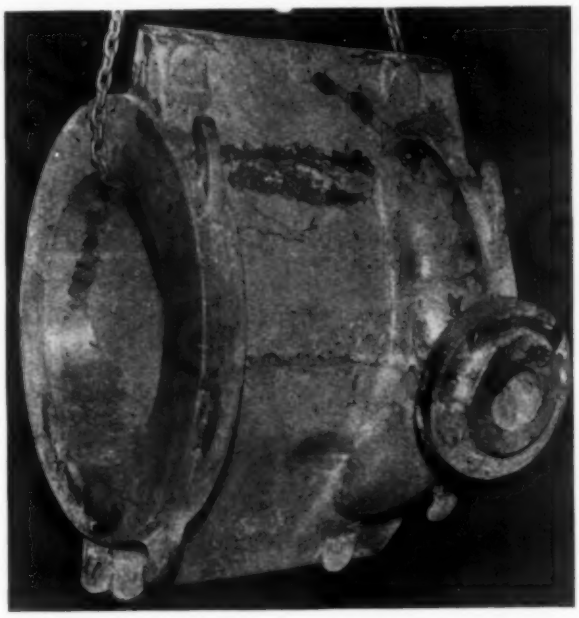


Fig. 3—A Large Barrel Pump Body Which Was Made to Withstand Exceptionally Severe Service Conditions

It weighed 21,000 pounds and was machined and tested to 1000 pounds hydrostatic pressure. It is subjected to superheated steam temperatures.

Oil refineries also require castings to resist high-temperature high-pressure conditions. Fig. 4 illustrates a spectacle valve, used in vapor phase refining. The particular cast-steel valve assembly shown in the illustration now is in use on a refining unit of the Shell Petroleum Corp. This valve handles hot oil vapor at 900 degrees Fahr. and 200 pounds per square inch pressure.

Fig. 2 represents another typical casting employed in oil refining operations. It is a hot oil pump end casting used by the Union steam Pump Co., Battle Creek, Mich., in pumps required to handle hot oil at pressure up to 1200 pounds per square inch and temperatures as high as 900 degrees Fahr.

Withstand Severe Service

Fig. 3 illustrates a large-size barrel pump body made for the Worthington Pump & Machinery Corp., New York. This casting was designed to stand up under exceptionally severe service conditions and is an excellent example of a type of large-size liquid pump casting which must be dependable and which modern steel foundrymen are daily being called on to produce.

Absolute safety is one of the prime requisites for high-pressure castings. They are therefore subjected to tests in which pressures two, three, or four times the working pressure are applied. The fact that failures in cast-steel pressure vessels are rare occurrences is an excellent testimonial to the painstaking care with which they are engineered throughout.

Steel castings of this class are made in a large variety of sizes and shapes, from those weighing a few pounds to massive ones weighing many tons, and from the simplest straight cylindrical pipe to the most intricate and complicated forms.

Publishes Bulletins on Industrial Sales

The department of commerce, Washington, through its industrial marketing section of which G. Reed Salisbury is chief, has completed the compilation of a series of seven bulletins providing "A Basis for Establishing Industrial Sales Territories."

The purpose of the bulletins is to set forth such statistics as emphasize the concentration of the industrial market by grouping the various counties of the United States into quarters, according to their rank of importance in each separate factor. The compilation is an effort to meet the insistent demand from sales executives in both large and small organizations for inexpensive and readily digestible material which will indicate the proper allocation of their direct sales efforts.

Titles of the bulletins are as follows: (1) Number of Manufacturing Establishments; (2) Wage Earners in Manufacturing Establishments; (3) Amount of Wages Paid in Manufacturing Establishments; (4) Cost of Materials, Containers, Fuel and Purchases of Electric Energy; (5) Value of Manufactured Products; (6) Value Added by Manufacture; and (7) Rated Capacity of Power Equipment.

Any one or all of the series can be obtained without charge by addressing the merchandising research division, industrial marketing section, department of commerce.

Opens Sales Office

Duriron Co. Inc., Dayton, O., recently opened a direct sales office in Buffalo under the management of Guy A. Baker, formerly of the general office at Dayton. Headquarters for the Buffalo district will be at room 420, Jackson building, 220 Delaware avenue. The company also has appointed H. P. Rodgers as represenative in the Cleveland territory with offices at 528 Leader building.

Samuel Frankel, formerly chief metallurgist and director of sales, Niagara Falls Smelting & Refining Corp., Buffalo, has been appointed director of sales, special alloys department, Federated Metals Corp., St. Charles street & Avenue L, Newark, N. J.

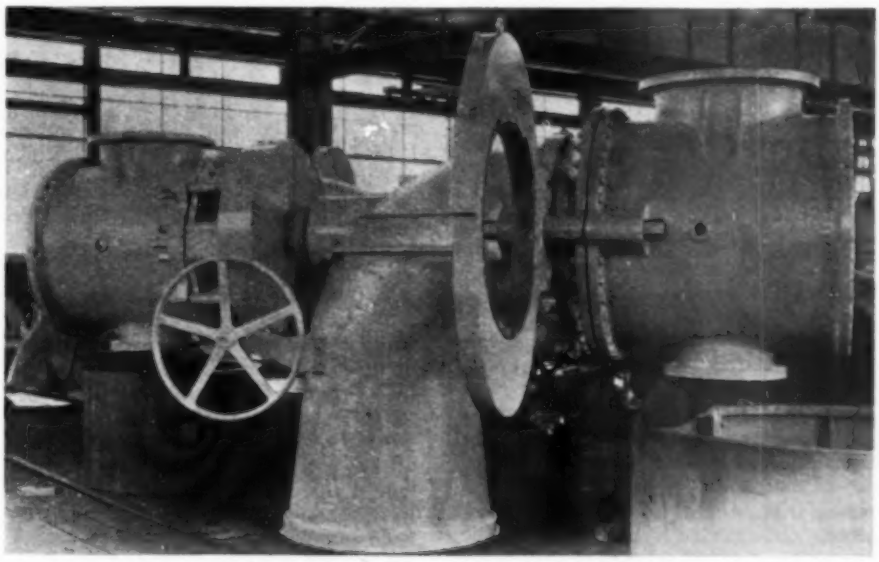


Fig. 4—A Spectacle Valve for Oil Refining Operations Where the Vapor Is at 900 Degrees Fahr. and 200 Pounds Per Square Inch Pressure

Reader's Comment

Editor's Note—Material appearing under this head does not necessarily reflect the opinion of THE FOUNDRY or of its editors.

Has Experience With Crucible

TO THE EDITORS:

In the Oct. 1 issue of THE FOUNDRY appears the article "Melting Aluminum in Electrically Heated Pot Furnaces" by Wirt S. Scott. This strikes us as being a particularly instructive article, since the author has set forth all his figures. He is perfectly correct in saying it is inefficient to use electric heat (presumably resistance) in attempting to melt aluminum in ceramic crucibles. However, even though the conductivity of a graphite crucible is less than that of iron, much aluminum is melted in electric resistance furnaces using graphite-clay crucibles. The principal difficulty has been not the low rate of heat transfer, but the fact that it is difficult to protect the graphite in the crucible from oxidation in the case of electric furnaces, as there are no neutral products of combustion as in the case of fuel fired furnaces. After the graphite is oxidized the conductivity becomes low.

Referring to Table II, giving electric furnace operating costs, the electric power cost equals $0.354 per 100 pounds and crucible cost $0.19. This cost for thermal energy is high although the rate is set at 1 cent per K. W. H. I have in mind two large installations using graphite crucibles melting aluminum and using oil for fuel, where the thermal energy costs $0.24 per 100 pounds and the crucible cost runs $0.05 per 100 pounds.

A statement to which I would take direct exception is the one in which the author says that great difficulty had been experienced in preventing the overheating of the metal and that this is due to the great amount of heat at high temperatures stored in the crucible. Let us see how that accords with the facts. The temperature rise is given as 130 degrees. The specific heat of aluminum is 0.219; the amount of aluminum in the crucible is 400 pounds, and the thermal input into the metal is 11,478 B.t.u.'s. The specific heat of the crucible is approximately 0.20 and its weight is approximately 100 pounds; therefore, for the crucible to deliver that amout of heat to the metal, it must have been at a temperature of 1944 degrees when the heating element was shut off. Now consider the iron crucible. The specific heat of iron at 1800 degrees Fahr. is 0.213. The weight of the iron crucible would, I guess, be 250 pounds, and the amount of heat stored in the iron crucible above 1370 degrees Fahr. is 30,500 B.t.u.'s, or almost three times that stored in a graphite crucible.

Undoubtedly several large foundries using graphite crucibles exclusively for melting aluminum had difficulties in getting the technique of operating the furnaces so as not to overheat the aluminum. These difficulties must have been overcome entirely satisfactorily as I have never heard a complaint in these shops on this score.

Vesuvius Crucible Co.
Swissvale, Pa.

RICHARD H. STONE

Institute Schedules Group Meetings

A winter program of approximately 30 local group meetings will be sponsored by the Gray Iron institute, 4300 Euclid avenue, Cleveland, according to Arthur J. Tuscany, manager. Tentative plans call for meetings in Chicago, Milwaukee, Cincinnati, St. Louis, Kansas City, Minneapolis, Detroit, Philadelphia, Buffalo, Pittsburgh, New York and the New England states. Mr. Tuscany will be in charge of the meetings.

Describes Rotary Type Melting Furnace

Operation of a rotary type, powdered coal fired furnace was described by Donald J. Reese, metallurgical engineer of the Whiting Corp., Harvey, Ill., before the regular monthly meeting of the Pittsburgh Foundrymen's association, held Nov. 16. About 50 attended the session. A moving picture of a furnace in operation producing high test iron supplemented the remarks of the speaker, and illustrated the method of charging, pouring and other steps in the melting process.

Makes Shot and Grit

National Metal Abrasive Co., 3560 Norton road, Cleveland, recently has been organized to produce metal shot and grit for pressure cleaning purposes. The plant, with a capacity of between 2500 and 3000 tons a year, recently was placed in operation. H. Marette is secertary of the company.

Opens New Pipe Plant

Although the new sand spun pipe plant of the Staveley Coal & Iron Co., Ltd., Chesterfield, England, has been in operation since June 3, the official inauguration did not take place until Sept. 16 and 17 when the company was host to 600 engineers and others connected with the water and gas utilities of the nation. In his welcoming address, Sir William B. M. Bird, chairman of the Staveley company said that the archives of the company went backto 1702 and that iron pipes had been manufactured certainly for the past 100 years. Before commencing the sand spun plant, the company's technical experts including the present manager James Duff had visited similar plants on the continent and in the United States and the present plant was modeled largely on what had been seen in the latter country. At the time of the opening, the plant was turning out approximately 600 sections of 4 to 12-inch pipe in 16-foot lengths per day. The Staveley Coal & Iron Co. employs approximately 12,000 men in the collieries, iron works, chemical works and iron stone mines.

Views Industry's Future

(*Concluded from Page* 51)

visible supply, usually present in the hands of consumers, but now practically unknown. With an estimated average of 70 per cent operation in business as a whole, Mr. Rose emphasized the need for initiative on the part of all manufacturers in building within their individual areas.

The poise, confidence and ability of working men to face stringent conditions were praised by Whiting Williams, Cleveland, who spoke from his recent experience among workmen, in breadlines, and among the unemployed in Cleveland, Detroit, Pittsburgh and points in the mining and steel centers of central states. According to Mr. Williams, the shock absorbers for the unemployed have been his residual savings, sometimes represented by his car, an appreciation of the lack of sinister intent and conversely a real effort on the part of individual employers to do their best through offering staggered employment and finally, the influence upon the women workers in the families, either through their contribution to the family expenses, if employed, or their faith and confidence through their own experience in the business and industrial world. A gratifying increase in social mindedness among employers is noted. In the same manner, the demands of radicals have been tempered on this occasion as compared with previous depressions. In the main, the unemployed man wants a job and there is no substitute for a job, except another job.

John L. Lovett, general manager, Michigan Manufacturers' association, who went to Russia during the past summer to investigate for his members the possibility of making collections in event that credit terms are broadened, gave an interesting discussion on the background and history of Russia, and the present conditions from first hand observation. Mr. Lovett believes that America has nothing to fear from Russian industrial rivalry, that the country will pay its bills, incurred in the purchase of machines and materials and that

recognition should not be withheld from that country.

From first hand observation, Mr. Lovett reported that the Stalingrad tractor works with 13,000 employes, in July showed from 29 to 56 completed machines per day during a ten day period. Furthermore, in the foundry which is equipped with six 20-ton cupolas, the average output is 6 tons per day and with as high as 80 per cent scrap loss. The employes' daily paper of this plant depreciated the loafing which was prevalent, stated that more than 4 per cent were absent each day and 149 were idle on one day for lack of work. Shop workers hold incessant meetings to decide whether instructions of foremen shall be carried out and foremen decline to take responsibility, even for attendance on the part of their men. These meetings, at times, last for days.

Foundrymen have felt some alarm over recent developments in rolled-steel, welded assemblies said R. A. Bull, director, Electric Steel Founders' Research group, Chicago. Instead of feeling alarmed, they really owe the welders a vote of gratitude, since the development in welding has forced foundrymen to improve the quality of castings and study more closely the requirements of consumers. Mr. Bull conceded that welded assemblies are best in certain applications and that forgings also are best in some uses, but that castings continue superior for the great majority of uses to which castings are being put.

The best way for a foundry to meet present conditions, said Mr. Bull, is to become thoroughly familiar with all factors involved in satisfying consumer requirements. These factors are principally those involved in quality and design of castings. Foundrymen should familiarize themselves with characteristics of competing materials; should understand thoroughly the possibilities of castings design and the possibilities for producing quality castings. This will enable them to understand consumers' requirements more thoroughly, and to sell castings intelligently.

Confident for Future

Statements by Mr. Bull and others present at the meeting reflected a pronounced faith in the future of the foundry industry. It was felt that competition from the producers of welded assemblies is only an incident in the foundry business, but that to meet this competition it is necessary as never before for foundrymen to be able to determine the uses for which castings of right quality and correct design are best, whether steel, malleable, gray iron or nonferrous. Incidentally, Mr. Bull reminded his hearers of the recent tendency toward the use of metal in external decoration of buildings, and predicted an increasing use of corrosion-resistant castings.

H. L. Hoefman, Link-Belt Co., Chicago, stated that it is a fallacy to believe that complete handling systems may be installed with profit only in large mass production foundries. Between 150 and 200 pounds of material and equipment have to be handled to produce one pound of castings. Small jobbing foundries, he said, may derive great advantage from handling systems, with resulting lower labor costs and increased output from the same equipment. He described a number of typical handling installations in small foundries.

Officers of the National Founders association were re-elected for another year, as follows: President, S. Wells Utley, Detroit Steel Casting Co., Detroit; vice president, Carl H. Hoffstetter, Odin Stove Mfg. Co., Erie, Pa.; secretary, J. M. Taylor, 29 South LaSalle street, Chicago.

Ohio Founders Hear Safety Talks

ENDORSING activities for the past 12 months, directors of the Ohio Foundries association, Cleveland, re-elected its officers at the annual meeting held Nov. 19 at the Deshler-Wallick hotel, Columbus. A. H. Kramer, Advance Foundry Co., Dayton, was re-elected president; J. H Bruce, Bowler Foundry Co., Cleveland, vice president; Charles Seelbach, Forest City Foundries Co., Cleveland, treasurer, and Robert Hoierman, Cleveland, secretary.

Election of officers followed the election of five members of the directorate. Four directors whose terms expired this year, W. P. Anglemyer, Star Foundry Co., Troy; Charles E. Dine, St. Marys Foundry Co., St. Marys; E. A. Leary, Cincinnati Steel Casting Co., Cincinnati and Charles Seelbach, were re-elected while James L. Wick Jr., Falcon Bronze Co., Youngstown, was the new member named to the board.

Organization for the ensuing year featured a brief session shortly before the 12:30 p.m. dinner. Attendance was somewhat smaller than was anticipated, but considerable interest was shown in the state wide safety campaign being sponsored by the association in an effort to reduce foundry accidents and secure a lower state insurance rate for next year.

The afternoon program featured safety addresses by Fred G. Bennett, Buckeye Steel Casting Co., Columbus; J. W. Beall, Ohio Steel Foundry Co., Lima and Springfield; Wellington T. Leonard, Dr. W. E. Obetz, and E. I. Evans, all of Ohio Industrial commission; and Thomas P. Kearns, superintendent, state department of safety and hygiene.

Mr. Evans pointed out that foundrymen are responsible for the insurance rates they are called upon to pay because they have failed to take steps to reduce accidents. Dr. Obetz in his talk on the importance of first aid treatment to prevent infection which he said was the basis for 28 per cent of foundry claims, declared that eliminating infection would result in a saving of $150,000 annually to foundrymen. First aid training, he said, not only reduces medical and compensation costs, but promotes greater safety among employes.

Plan Eastern Meeting

Charles A. Klaus, cost consultant of the Newark cost group and the Gray Iron institute will speak on "Actual Experiences in Cost Group Work," and Henry Sokolsky, time study supervisor, B. F. Sturtevant Co., Boston, will speak on "Possibilities of Wage Incentives in the Foundry" at the regular monthly meeting of the New Jersey Foundrymen's association to be held at the Downtown club, Newark, Wednesday evening, Dec. 2.

Connecticut Founders Meet at Meriden

The one hundred and forty-ninth meeting of the Connecticut Foundrymen's association was held at the Home club, Meriden, Conn., on Friday evening, Nov. 13. In the absence of J. D. Coltman, who was to report on the recent annual meeting of the Gray Iron institute, the meeting was devoted to the discussion of various foundry problems, including tuberculosis in the foundry and its relation to workmen's compensation laws. Carl S. Neumann and Alex Smyrk, Union Mfg. Co., New Britain, Conn., described some recent experiments with core oil at their plant.

The Rust Engineering Co., Pittsburgh, has acquired the McCann-Harrison Co., Cleveland, builder of industrial furnaces.

Questions & Answers on FOUNDRY PRACTICE

THIS department covers all problems relating to metallurgical, melting and molding practice encountered in making steel, malleable-iron and gray-iron castings. Questions submitted by bonafide subscribers to this department will be answered by members of the editorial staff of The Foundry, supplemented where occasion requires by the advisory staff whose personnel is as follows:

John H. Hall
Cast Steel

H. A. Schwartz
Malleable Cast Iron

J. W. Bolton
Gray Cast Iron

All questions must be addressed to the Editor, The Foundry, Penton Building, Cleveland.

STEEL

Figure Steel Shrinkage

Students in our vocational school pattern shop would like to know how the patternmakers at the plant of the Bethlehem Steel Co. decided on the proper amount of shrinkage to allow on the pattern for the hydraulic forging press platen described and illustrated in the Sept. 1 *issue of* THE FOUNDRY.

Experience gained over a period of many years in the preparation of patterns for large steel castings, indicated that the usually accepted standard contraction allowance of ¼-inch to the foot did not apply in this instance. An allowance of ⅛-inch to the foot was allowed and the casting came out almost exactly as anticipated. In height and width the casting conformed precisely to dimensions. In length the casting exceeded expectation by ½-inch, but extra stock had been allowed on all machining surfaces to take care of any possible discrepancy of this kind.

Theoretically and for purpose of calculation and instruction every metal has been given a definite contraction allowance and all patterns are made with that allowance in mind. The allowance is based on the distance a metal will shrink or contract while passing from the molten state at high temperature to a solid state at ordinary atmospheric temperature. Also this allowance has been calculated on plain, straight bars, cast in such a manner that they are free to contract to their natural limit. Thus on steel castings, this limit has been found to be ¼-inch to the foot. However, many castings are neither plain nor straight. Outside projections and interior cores prevent the metal from contracting to the natural limit. In instances of this kind the patternmaker has no rule to guide him save his own experience. In the past he has checked casting dimensions against his patterns and noted the variation between anticipated and actual sizes. In the course of time he develops a species of sixth sense or instinct which guides him in the application of his shrink rule. The standard shrink rules employed by patternmakers are applicable in the majority of cases, but in many instances they do not apply. Knowledge on how to meet these emergencies can be gained only through actual experience.

GRAY IRON

Wants Higher Carbon

We melt gray iron in a cupola. The iron has a normal analysis with regard to total carbon, silicon, manganese, sulphur, and phosphorus for machine castings, but in our opinion the combined carbon is too high. How can the combined carbon be reduced without changing the mixture, say for example by varying the amount of air blown in, changing the tuyere passages, etc? When a large amount of steel clippings is added in our cupola, the total carbon drops considerably. What can be done to prevent that so that the carbon remains around 2.9 *to* 3.0 *per cent?*

The simplest way to reduce the combined carbon is to increase the silicon content of the cupola charge. However, it is our experience that irons containing about 3.0 per cent total carbon are nearly pearlitic, that is contain from 0.60 to 0.70 per cent combined carbon, even when poured into test bars 3 inches in diameter. Iron with such a structure is excellent for strength and wear resistance although it is harder to machine than an iron with more ferrite.

If you desire better machinability with some sacrifice in hardness, it is suggested that you increase the amount of coke between charges in your cupola, allow the molten iron to accumulate in the well or reservoir of the cupola before tapping, and avoid excessive blast. Those methods will result in a greater carbon pickup, and a softer iron.

Q & A

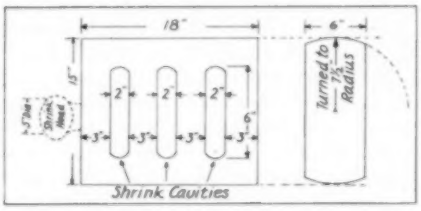
Reduce the Silicon

We are making some heavy castings of the dimensions indicated in the accompanying sketch, and we are having difficulty with shrink cavities at the ends of the cored holes marked on the sketch. The mold is tilted slightly and we feed from the high end. The castings are made from an all scrap mixture made with 380 *pounds of clean cast scrap;* 20 *pounds of steel scrap;* 3 *silicon briquets containing* 1 *pound of silicon, and* 1 *manganese briquet containing* 2 *pounds of manganese and* ½*-pound of silicon.*

If it is assumed that the machinery scrap you are using contains 2 per cent silicon, calculations show that your final iron contains about 2.50 per cent silicon; 0.80 per cent manganese, and about 0.50 phosphorus. The castings will weigh about 365 pounds and with the silicon content indicated will have a tendency to be soft and open-grained. Therefore, we suggest

that you reduce the silicon content to not over 1.5 per cent, which will give a stronger iron. A suggested mixture is 225 pounds of machinery scrap, 175 pounds of steel scrap, 2 silicon briquets and 1 manganese briquet.

While you do not state whether the cores are vented or not, it is suggested that you ram up three ½-inch rods in the core when making them. Place one in the center and the other two about 1-inch from the ends. The rods are removed before drying. The holes left in the dried cores are vented to the exterior surface of the mold through holes of about the same size.



A Shrink Was Encountered at the Ends of the Cored Holes

While you mention that you are using a 6-inch cope, it is not readily apparent whether the casting is made all in the drag or only half in the drag. If it is the latter, you only have a 3-inch effective head which is not sufficient. Increase it to 6 or 8 inches by extending the sprue and riser the additional distance above the top of the cope.

Q & A

Slag Color Changes

We are melting a high quality gray iron in a 32-inch cupola. The construction of the cupola and the regulation of blast, height of coke bed and coke to iron ratio are such, that extremely high temperatures are reached. However, while the same materials, flux, coke, etc., are used, and melting under the same conditions, we notice that the slag sometimes is a deep green color and other times is quite black after cooling. We often melt mixtures containing 50 per cent steel. The total area of the 5 tuyeres is 172 square inches; the iron to coke ratio is 7.7 to 1, and the melting rate is about 9200 pounds per hour. What is the right quantity of air per ton of iron and per hour for the 50 per cent steel mix, and what will be the right quantity of air using only 10 per cent steel in the mixture? Does the quantity of air per ton of iron and per hour vary for cupolas with larger dimensions?

Apparently while your melting conditions appear to be the same, there is some variation which is indicated by the change in color in the slag. To satisfy yourself on that point, we suggest that you have the different colored slags analyzed to determine the difference in composition. A good slag, according to Bolton, should have the following composition: 35 to 45 per cent silica; 30 to 40 per cent lime and magnesia; 5 to 26 per cent alumina; 5 to 8 per cent iron oxide, and 1 to 3 per cent manganese oxide. Low lime slags high in silica are generally high in iron, and high iron slags are black or brown, which do not wool freely. Wooling is the tendency of the slag to be ejected from the slag hole in the form of feathery, thread-like particles which float around. A good slag is black with some brown or green shades and a whitish incrustation. When ground, such slag will be nearly white. High iron slags are dark when ground. The appearance of the fractured surface of the slag is an indication of whether a good slag is being produced or not. Good slag usually has a glassy appearance, while those not so good are dull.

With an iron to coke ratio of 7.7 to 1 and a melting rate of 9200 pounds per hour, 1200 pounds of coke are consumed. Theoretically it requires 132 cubic feet of air at 60 degrees Fahr. and 14.7 pounds per square inch barometric pressure to burn one pound of coke to carbon dioxide. Therefore, to burn 1200 pounds of coke in one hour as you are doing, 158,400 cubic feet of air will be required or 2640 cubic feet of air per minute. The value given is the theoretical requirement, but by some experimentation on your part, you may find that you can produce hot iron with less air, or possibly it may require more.

The amount of air supplied to the cupola must be based upon the quantity of coke that is burned in a given time. Consequently, it makes no difference whether you are melting 50 per cent steel or 10 per cent steel as long as the quantity of coke used between charges is the same. Larger cupolas require more air per minute or per hour than small cupolas because their melting speed, and consequently the coke consumption per minute or hour is greater.

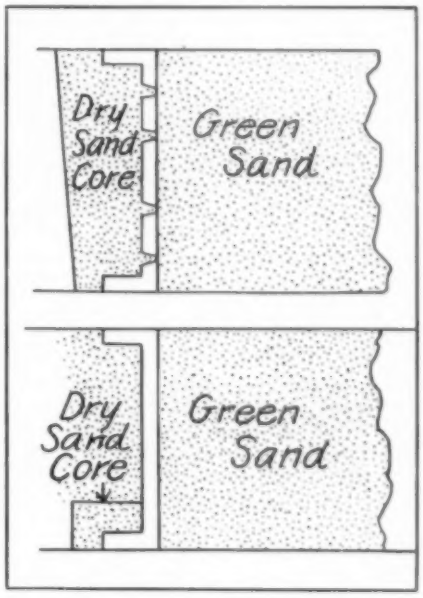
GENERAL

Make Mold for Flask

We are thinking of making some cast iron flasks in various sizes for our own use and will appreciate your opinion on the best type of pattern and molding method to employ.

Assuming that the flasks are to be of the usual type with flange top and bottom, either of the two methods shown in the accompanying illustration may be employed with satisfactory results. In the upper illustration a dry sand core, or rather a succession of dry sand cores, forms the entire outer face of the mold. The actual number of cores depends on the flask size.

With a fairly rigid box built around the outside of the pattern for a core print, this type of pattern has a slight advantage over the pattern employed in making the second mold shown below. It will hold its shape better and over a longer period. Also it may be entrusted to a molder of even mediocre skill with a reasonable expectation of securing a casting true to shape. On extremely large flasks the outer core print may be omitted from the pattern. The body of green sand is built up either against the inside wall of a one-piece pattern, or, against a sectional improvised wall of any kind.



Below—A Dry Sand Core Forms the Lower Flange, Above—The Dry Sand Core Forms the Entire Outer Face

On circular flasks the inner body of green sand may be swept to shape. The cores destined to form the outside face of the mold then are erected on the outside with suitable shoulders top and bottom to regulate the thickness of the anticipated casting. Sand then is rammed against these cores and is held in place by the walls of a pit, curbing, etc.

In the second method, shown in the lower illustration, a plain box pattern is employed to form the inner part of the mold. Pattern for the top flange preferably is fastened to the box to promote rigidity. Even with the flange in place, it is advisable to fasten diagonal strips across the pattern to preserve the shape until it has been rammed full of sand. An unexperienced molder will be surprised to find how far this pattern may be distorted from its proper shape if it is not watched closely. Some men prefer to prepare a level bed for the reception of the pattern. Others are satisfied to level the pattern from the top. In the first instance the angle cores to form the lower flange are laid against the outside lower edge of the pattern without further preparation. In the second instance a scraper riding on the top edge of the box pattern is employed to scrape a seat for the cores at the bottom.

Problems in Nonferrous Founding

By Charles Vickers

Melting Is At Fault

We are sending you a piece cut from a bronze bushing 9 inches in diameter and 17 inches long made in the 80 per cent copper, 10 per cent tin, and 10 per cent lead alloy. You will notice that the bronze is filled with irregularly shaped specks throughout. It seems to make little difference whether all new metals or ingot metal is used. Two bushings poured from the same pot often show considerable difference; one showing only a small trace of the dross while the other will be full of it. Normally we use one-fourth pound of 15 per cent phosphor-copper as a deoxidizer to 100 pounds of the alloy. We have tried different crucibles, changed from oil to gas fuel, different sands, etc. Different pouring temperatures also were tried and we seemed to get the best results with 1850 degrees Fahr. on the larger and 1900 degrees Fahr on the smaller castings. Bottle glass, silica sand, charcoal alone and with salt, black oxide of manganese, plaster of paris, etc., have been tried as covers without results. Castings of all sizes are otherwise sound, apparently containing no gas or blowholes until machining shows the sawdusty effect.

In view of all the changes you have made, apparently there is some thing fundamentally wrong which persists through the various changes. Examination of the changes you have made indicate one possible source of trouble, and that is the conditions of melting. While you have changed from oil to gas and back again, undoubtedly you have failed to observe the condition of the furnace atmosphere. If a reducing atmosphere was present your trouble will be solved as soon as you provide a slightly oxidizing atmosphere by increasing the amount of air to the burner. Before making any change we suggest that the following experiment be made: Just before pulling the pot stir in about 2 ounces of litharge without the phosphor-copper and observe the results. It may be necessary to increase the amount of litharge. If the additions improve the metal, you may be sure that a reducing atmosphere is present in your furnace as the litharge is an oxidizing agent. Bring your metal to at least 2200 degrees in the furnace and pour at 2100 degrees Fahr. as many heavy mill bearings have been cast at that temperature with low production losses.

Q & A

Makes Tobin Bronze

Recently we received an order for some tobin bronze castings to be made according to A.S.T.M. specifications. Can you give us information on what composition the specification calls for?

Search of the American Society for Testing Materials standards and tentative standards does not reveal any specification relating to tobin bronze, and it is possible that your customer may have made an error in ordering. It would be well to check that point before proceeding. Tobin bronze has a varying analysis. One cast specimen contained 60 per cent copper, 38 per cent zinc, and 2 per cent tin. A suggested mixture contains less tin and a little more zinc than the one mentioned, and in addition contains some aluminum. That alloy is made with 59 pounds of copper, 39.25 pounds of zinc, 0.75 pounds of tin, and 1 pound of a copper-aluminum alloy containing 1 per cent aluminum. The tensile strength of tobin bronze will run about 52,000 pounds per square inch with an elongation between 30 and 40 per cent.

Q & A

Hard Spots Are Iron

We are having considerable trouble with our bushings which range from 3 to 5 inches in diameter and are 10 inches long with cored holes from 1 to 3 inches in diameter. We encounter hard spots which seems as hard as steel, and they take the edge off tools. They are found on the inside of the bushing next to the core, and the only thing we can do is to chip them out. Natural draft furnaces with 85-5-5-5 ingot metal and return sprues are used. The brass is covered well with charcoal and a proprietary deoxidizing alloy is employed. We are sure there is no iron in the brass.

While we do not know how you arrived at your conclusion that there is no iron in your brass, your description of the trouble encountered definitely indicates that it is present as it is the only thing that causes such hard spots. The iron causing the hard spots is not combined with the brass, but exists as free, hard nodules distributed through the metal. Chemical analysis often does not reveal iron because the probability of striking one of the nodules in sampling is remote. Next time you strike one of the hard spots, chip it out, and have it analyzed. Also have some micrographs made of the sections in which the hard spots appear.

Q & A

Eliminates the Lead

One of our customers is insisting upon having a bronze which will turn off like steel in long strings, and if the speed is increased on the turning then these chips will turn blue. We have cast some of this metal before but have misplaced the formula.

It is unfortunate that you did not obtain information from your customer on the purpose for which he wished to use the bronze. Therefore, it is suggested that you get in touch with him and obtain that information as then you will be in a position to supply a bronze of the proper composition that will meet the service requirements. As far as the bronze which will machine with long turnings and turn blue at higher speed is concerned, we believe that any number will meet those conditions as long as they do not contain any lead. The latter material is added to many bronzes and particularly brasses to prevent long, curly turnings. A striking example is the employment of lead in screw stock brass which is used in automatic machine work. The long curly turnings are not desirable on that class of work as they clog the cutting tools. Possibly you can meet your customers' requirements with the following alloys:

Copper, 88 per cent; tin, 10 per cent; and zinc, 2 per cent—Copper, 88 per cent; tin, 8 per cent; and zinc, 4 per cent, or copper, 89 per cent; tin, 11 per cent, and phosphorus, 0.3 per cent.

BILL

By Pat Dwyer

Describes Making Pattern Plates

A GIFTED lad in our town, a member of the staff on a morning paper, has been writing a series of short sketches on old time songs, the doleful, comical and in some instances downright silly ditties of yester year. I can remember when many of them were in vogue and how easly the words and music were picked up and memorized, and then forgotten just as readily.

That statement is not quite accurate. Only the weird combinations of words were forgotten. The titles and the tunes always remained in the active file ready to come to the front in answer to a few words for one and in response to a few bars whistled or sung or produced on any kind of musical instrument, for the other.

Among the list of resurrected songs in the newspaper series I recognized one that was considered a veteran even in my early days. This particular song was of the same robust character as *Hail, Hail, the Gang's All Here; Mary Ann McCarthy Went Out Digging Clams*, etc., a rough, jovial composition more adapted to athletic, bouncing, out door surroundings than to the restrained atmosphere of the parlor. A great favorite at molders' barbecues, clambakes, smoking concerts and other forms of innocent amusement highly popular in the days when people had to depend on street cars and trains to take them there and bring—or carry—them back.

The words of the song lent themselves readily to the boisterous, back slapping atmosphere. "Are you Mr. Reilly they spake of so highly?" "I am!" "Are you Mr. Reilly who keeps the hotel?" "Sure t'ing!" "Thin if you're Mr. Reilly they spake of so highly (both together in close harmony) 'Pon me sowl Reilly, you're doin' . . . well!"

Singing at best is dry work. Therefore it was only natural at the conclusion of each rousing stave that the character impersonating Mr. Reilly should maintain his standing by announcing that the drinks were on the house.

Curiously enough the compiler of the newspaper articles saw fit to introduce *I Cannot Sing the Old Songs* immediately after the reference to the composition extolling the virtues of Mr. Reilly.

When Bill came in the other night whistling a few bars from the epic account of the sterling hotel keeper I regarded the incident as an odd coincidence. I asked him if his memory had been jogged, as mine had been, by reading the series of newspaper articles.

"Well," said Bill, "I'll tell you. A friend of mine traveling down east lately fell in with Jimmy Reilly in Syracuse. You know Jim at the Empire. He wished to be kindly remembered and so forth and also told this traveling friend of mine a strange tale of a highly trained and intelligent ox. Thinking over the combination undoubtedly touched on some spring in the old memory and the result is that I find myself whistling over an old stave I had completely forgotten. Must be some kind of an automatic release—"

The Visitor Hears the Story of the Ox

"I have just been through the same experience," I said, "so you need waste no time in speculating on, or, in presenting a theory to account for the phenomenon. What is this story about the ox? Unfortunately I am not in a position to offer an opinion on the mental endowments of an ox, but in a general way I have gathered the impression that the animal usually is awarded a minus *X* grade in an intelligence test. Seems to me that in times of stress and strain I have heard the expression 'As dumb as an ox.'"

"Oh, well," Bill admitted, "there are oxen and oxen. You may have heard or read of *Babe* the famous blue ox who, that or which—take your choice—rendered such valiant aid to Paul Bunyan in his tremendous feats of strength, skill and endurance."

"Yes," I said, "and 20 or 30 years ago I read some wonderful stories of one Dr. Bunyan and his famous bull. Am I to understand that the animal you have in mind traces its pedigree back to one of these noble individuals?"

"Well," said Bill, "I am afraid the owner might experience some difficulty in attempting to trace any relationship to the first. So far as my observation extends, oxen have been singularly deficient in providing any direct line of succession. The second is in the bounds of possibility, but considering the sagacity of the animal, seems highly improbable.

"The point really is of no importance. After all an ox is an ox and when you say that you have said all that is necessary. In life it is employed as a beast of burden and after it dies of old age it is served up as prime young veal and oxtail soup. A highly useful animal, singularly lacking in social graces and—with the exception to which I referred some time back—even to a greater extent—if that is possible—lacking in mental endowment. This ox I am telling you about worked in a foundry."

"I suspected something of the kind. Did he work on the floor or on the bench?"

"On the floor," Bill replied with a grin. "In fact he was called in only when a particularly heavy job had to be handled.

"It was on a bright summer morning, when the birds sweetly sang on each bough—see how association of ideas brings up *The Pretty Girl Milking Her Cow*—well, anyway, a hobo molder drifted into this little foundry one day and asked the owner for a job. The owner told him that he had an order for a particularly large casting, but through lack of experience had hesitated to tackle it alone. If the applicant could assure him that he was accustomed to heavy work and that he coulld mold this particular piece, he would be happy to put him to work.

"The molder earnestly assured his prospective employer that he was qualified to mold anything from a door catch to a 100-ton engine frame. In fact he modestly admitted that he had quit his last job because all the heavy work was finished and the gaffer had been tactless enough to ask him to work on chicken feed and flat backs. 'I don't suppose you'll believe it,' he said, 'but dere wuzzent a t'ing over

two or t'ree hundert pounds in de lot.'

"When the old man showed him the pattern and the flask he admitted that the job would be only child's play to him if he had any suitable rigging. However, he saw no sign of a crane or any other lifting device in the shop,

The Tourist Would Tarry for a Brief Period and Then Take Wing

therefore he had to decline the honor.

" 'You go ahead and make the mold,' says the old lad, 'and I'll attend to the liftin' when the time comes.'

"The molder bedded the job in the floor and rammed an 8 or 9-foot cope on top of it, then told the proprietor that was the end of the line, he could go no farther. The old lad allowed, he did, that he could supply a transfer.

"He rigged a rope sling on the handles of the cope, fastened the sling to the hook of a block and tackle suspended from the ridge pole, ran a lead line through a snatch block anchored to one of the sills and then marched a big ox in from the barn and hooked him to the line. The ox walked away with the load and the cope rose in the air a sufficient height for the molder to work under it.

" 'That's a pretty smart ox you have there,' the molder suggested, admiringly. 'Did you notice how nice and slow he snuk along so as not to jerk the load? Smooth, I calls it. Smooth and slick as oil!'

" 'Smart?' says the old boy, 'I'll say he's smart. Meanin' no disrespect to present company, he knows more about a foundry than half the bums I've seen floating through here in the past ten years. Did you see him looking back after the cope commenced to rise? Hey? Did you see that?'

" 'Yeah. Sure I seen him,' the 'bo says. 'I seen him rubberin' awright, awright, an' I wuz jis wonderin' maybe if sumpin I said or done give him a pain in his big, t'ick neck.'

" 'Not at all! Not a-tall. Far from it my boy. I can tell by the way he wags his tail he has taken quite a fancy to you. He was just looking back at the mold to see what kind of a lift you got!' "

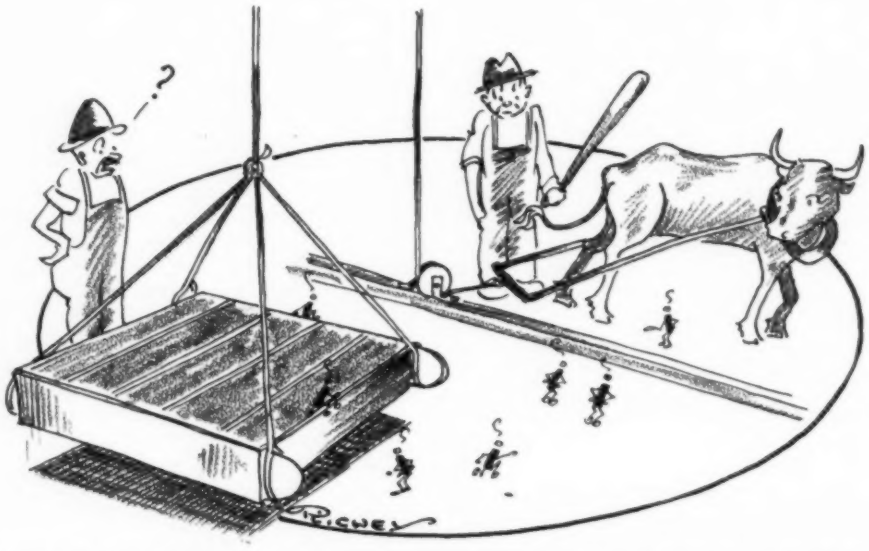
"Talking about odd jobs," Bill continued, "reminds me that big jobs are not the only kind that present difficulties. Any job is a puzzle to a man who is not familiar with it. I had an inquiry recently from a man who wanted to know what method is employed for making stove plate patterns to be used on molding machines where one machine is used exclusively for making copes and the other machine is devoted to the production of drags. He did not say what kind of metal he intended to use for these pattern plates, but that is a minor detail.

"Two methods are available for making metal pattern plates in which the joint or parting may be irregular, in which the pattern is cast integral with the plate and where one side or one pattern is to be used on one machine to make cope molds, while the other half, or side, is to be mounted on a second machine to make drags. Under certain conditions it may be advisable to make two complete matchplates, that is, duplicate plates, with a cope impression of the pattern on one side and a drag impression of the pattern on the other side. One may be mounted cope side up on one machine and the other may be mounted drag side up on the other machine. However, under other conditions, large masses of metal, etc., it is advisable to make two individual plates, suitably recessed on the back to present a fairly uniform thickness of metal throughout the plate and the pattern and thus prevent shrinkage and warpage defects.

"Method for making two plates is almost the same as the method for making a single matchplate with part of the pattern on one side of the plate and the remainder on the opposite side. The only difference between the two methods is that two duplicate and interchangeable flasks are required to make the two plates, while one flask is sufficient to make the regular one-piece matchplate.

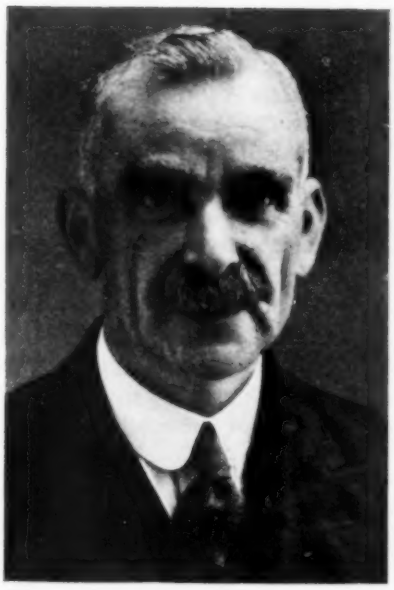
"The mold in the first flask is made in the usual manner with particular reference to an accurate, smooth and firm parting line. The cope is removed and placed to one side. A second cope is rammed, removed and laid upon its back. The pattern is removed from the drag and placed accurately in position on the second cope. A second drag is rammed and then lifted off. In the first instance the cope and drag are reassembled in the regular position with the cope on top. In the second instance the position of the parts is reversed and the drag is placed on top of the cope. Of course this is not imperative in all cases, but usually it is advisable to cast the working face of the pattern in the drag, or lower part of the mold.

"Before each mold is closed, strips of wood, or other material the desired thickness of the pattern plate are placed on the flange of the drag flask. A frame the exact size and shape of the desired plate then is placed in position on the joint and the space between the outside of this frame and the inside edges of the strips is packed firmly with sand and scraped off flush. The frame is removed, but the strips are allowed to remain. When the cope in one instance and the drag in the other instance is replaced, the strips support the weight, while the narrow sand dam prevents the metal from running out. Other phases of double pattern mounting were covered in the April 1 and April 15, 1922, issues of THE FOUNDRY. A comprehensive series of seven articles on pattern mounting methods was presented in successive issues of THE FOUUNDRY from Feb. 1 to May 1 of that year. Later they were incorporated in book form with many other articles under the title: *Tales from the Gangway.*



Nominated for Place in Hall of Fame Beside Paul Bunyan's Famous Blue Ox Babe

The FOUNDRY Family Photograph Album



Uper Left

J. L. MAHON

American Car & Foundry Co. Detroit

Upper Right

W. CHENEY JR.

S. Cheney & Son, Manlius, N. Y.

Lower Left

JOHN CAMERON

Cameron & Robertson Ltd., Kirkintilloch, Scotland

Lower Right

R. E. PRUSSING

Whiting Corp., Chicago

DAN M. AVEY
Editor

The Shakeout

FRANK G. STEINEBACH
Managing Editor

PAT DWYER
Engineering Editor

EDWIN BREMER
Metallurgical Editor

CHARLES VICKERS
Nonferrous Editor

NORMAN F. HINDLE
Assistant Editor

¶ Hands on Your Pocketbooks

REPORTS emanating from the automotive districts during these days of returning confidence indicate that the purchasing departments of some of the large manufacturing interests have suffered no permanent impairment of nerve. The term nerve here is used in the entirely disrespectful sense. One automobile builder is said to have circulated inquiries and accompanying prints asking for bids on an indefinite tonnage of castings for the first half of 1932. The quantity required is left open to specification according to requirement.

THIS is in accordance with past practice and is a recognized method of buying automotive castings. However, a further clause is the barb in this inquiry, according to reports. The successful bidder is asked to bind himself to furnish the last half requirements to this builder at the same price. Doubtless this indicates a hopeful optimism on the part of the buyer. He expects such a marked improvement in business during the closing months of 1932 that he wants the foundry to take all the risk and responsibility for probable rising costs. What has the foundry to gain from such a contract? Frankly, nothing.

DOUBTLESS, after the lean months many foundries might be inclined to accept such a contract. With the hunger for business, the assurance of some sort of tonnage for the entire year might look like an unmixed blessing. However, if business does improve as markedly as this buyer seems to expect, what of the foundry's situation when faced with rising costs of fuel, metal and labor. That labor rate which has been *liquidated*, to use the euphonistic term so aptly applied by the Russians, may be subject to an upward push in line with the law of supply and demand, which the past depression has demonstrated still is in full force. The only result of such a contract in face of these conditions is loss, probable labor difficulties and extremely doubtful final profit or satisfaction to the buyer. Let's be fair Mr. Castings Buyer.

¶ Each Must Play A Part

STATISTICS of the National Society for the Prevention of Blindness show accidental eye injuries the greatest single cause of blindness. While numerous large firms have given serious consideration to that phase of accident prevention, many companies disregard it entirely. Why should industry continue to pay a heavy bill for compensation when it might be materially reduced by the proper safeguards?

¶ What's in a Name? Plenty!

ONE of the characters immortalized by the late Mr. Shakespeare is responsible for the statement that a rose by any other name would smell as sweet. Those who quote this statement so glibly—in many instances so glibly that the hearer is convinced he is listening to the original author—seem to overlook another tried and true veteran of the oft quoted ranks: Give a dog a bad name and you might as well hang him. The majority of foundrymen have little opportunity to dally with the aroma of roses or to split hairs over the name by which it should be known. Dogs with names—Ah! Here we have a horse with an entirely different set of shoes.

E. H. BALLARD, president of the American Foundrymen's association, in an address recently delivered before the Foundry Equipment Manufacturers association, stated that the term *sandblast* carries a certain stigma—a hangover from former days of innefficient equipment—and he would like to see the term *pressure cleaning*, used in its stead, in all operations where an abrasive material is employed under pneumatic pressure as a cleaning medium. He cited several reasons for this desirable change. In many installations a metallic abrasive is employed and as a result any inclusion of the word *sand* is misleading. However, the principal reason for advocating the change lies in the fact that former cases of silicosis developed in the experimental sandblast period have unduly prejudiced the minds of those who administer the workmen's compensation and industrial accident laws and as a result the foundry is penalized to an extent not justified under present conditions.

LARGE bodies move slowly. This applies equally to mental and physical movement and in a special manner it applies to bodies set up to interpret and administer the law—any law. So long as the law is guided—and guided solely by precedent—the *sandblast* process will be penalized for ancient errors. Introduce a new term for what practically is a new process and the law makers will have to formulate a new set of rules—a set justly based on present conditions.

Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

FREDERICK J. FAY, formerly foundry superintendent, the Gifford-Wood Co., Hudson N. Y., recently was made foundry superintendent of the Finch Mfg. Co., Sranton, Pa. He also served for several years as foreman and metallurgist, Dodge Co., Mishawaka, Ind. Mr. Fay is a graduate of McLain's system Inc., Milwaukee, and Wentworth institute, Boston.

J. B. Berryman has been elected president of the Crane Co., Chicago, succeeding the late R. T. Crane Jr. Mr. Berryman, who has been connected with the company many years, has been first vice president.

Dr. C. H. Lorig, Battelle Memorial institute, Columbus, O., addressed a meeting of the Wisconsin Gray Iron Foundry group held at the Hotel Schroeder, Milwaukee, on Wednesday, Nov. 11.

C. A. Liddle, president of the Pullman Car & Mfg. Corp., Chicago, has been elected president of the Standard Steel Car Co., a subsidiary, succeeding **P. H. Joyce,** who becomes chairman of the board. Mr. Joyce recently was elected president of the Chicago Great Western railroad.

Harry W. Dietert, research engineer, U. S. Radiator Corp., Detroit, addressed the regular monthly meeting of the New England Foundrymen's association in the Engineers club, Boston, on Nov. 11. Mr. Dietert spoke on "Foundry Control" and illustrated the address with numerous lantern slides.

George C. Pascall has been made president and treasurer of the Pickering Governor Co., Portland, Conn. Mr. Pascall entered the employ of that company in September, 1902, and has served an apprenticeship of over 29 years in various capacities. **Heman Ely** has been elected chairman of the board of the Pickering company, succeeding the late Stephen S. Hall.

William H. Jacobi, formerly general manager of the Keokuk Steel Casting Co., Keokuk, Iowa, subsidiary of the Springfield Boiler Co., Springfield, Ill., now is affiliated with the Continental Roll & Steel Foundry Co., East Chicago, Ind., in the capacity of sales engineer, specializing in cast steel pressure vessels and fittings of all kinds, both rough and finished.

Charles E. Adams has resigned as president, Cleveland Hardware Co., Cleveland, and has been named honorary chairman of the board. **Thomas P. Robbins** has succeeded Mr. Adams as president. Other officers named at the company's meeting Nov. 9 are **Malcolm L. McBride,** treasurer; **Henry S. Sherman,** secretary. **Edgar E. Adams** has retired as vice president and general manager.

Donald M. Scott, formerly vice president, Gould Coupler Co., Rochester, N. Y., has been made vice president of the Buffalo Electric Furnace Co., Buffalo. **Thomas H. Nelson,** Midvale Steel Co. and **Dr. Gilbert E. Seil,** E. J. Lavino & Co., Philadelphia, also have become connected with the Buffalo Electric Furnace Co.

D. M. Scott

C. Walter Yost, superintendent of foundries, the Midvale Co., Philadelphia, led a discussion on "The Operation of the Cupola, Calculation of Cupola Mixtures and Analysis for Classes of Castings," at the meeting of the Philadelphia Foundrymen's association, Inc., held Wednesday evening, Nov. 11, at the Northeast Shrine Club, Philadelphia. The discussion centered around the report of the gray iron committee of the American Foundrymen's Association on recommended practices.

Daniel Sharpe, for the past 10 years manager of the Foundry Plant & Machinery Ltd., Glasgow, Scotland, has received an appointment with Messrs. Walter Macfarlane & Co., Glasgow, which has necessitated his resignation as manager. However, he has retained a connection with the Foundry Plant & Machinery Ltd. and recently was elected to the board of directors. James Affleck, formerly foundry manager, Messrs. G. & J. Weir Ltd., Cathcart, Glasgow, has been made manager succeeding Mr. Sharpe.

New Jersey Founders Hold Joint Meeting

A joint meeting of the New Jersey Foundrymen's association and the Metropolitan section of the American Society of Mechanical Engineers was held at the Downtown club, Newark, N. J., recently. A joint meeting of these two organizations has been an annual affair for several years. E. M. Johnston, Syracuse, N. Y., addressed the group on "Creating Salesmanship" and Harold Lord Varney, spoke on "Safeguarding American Ideals."

Supplements Cost Work

During the past two years, a new procedure in steel foundry accounting and cost methods has been developed by the Steel Founders' Society of America Inc., Graybar building, New York. While the general layout of accounts and cost methods are covered in the *Uniform Cost Manual,* published by the society, a series of supplements are to be prepared, describing more in detail the proper manner in which to handle various elements of cost procedure.

The first of the supplements recently has been completed, and covers the structure and method of using a recently designed standard estimate form, which ties in with and conforms to the uniform cost plan. The principles of the procedure in cost accounting have been printed in a loose leaf cost manual which is available to all foundries at less than cost. A copy of the special form recently prepared will be sent to anyone requesting it from the Steel Founders' Society of America.

Equipment Sales Up

Index of orders for foundry equipment for October was 45.9, compared with 31.9 in September, according to a recent report of the Foundry Equipment Manufacturers' association. Index of unfilled orders was reported as 56.8 on Nov. 1, compared with 35.6 on Oct. 1.

OBITUARY

Richard T. Crane Jr., 58, president of the Crane Co., Chicago, manufac-turer of heating and plumbing supplies and equipment, died in a New York hospital Nov. 7. He began his business career in the foundries of the company, started in 1855 by his father, after his graduation from Yale university in 1896. A year later he entered the sales department, and in 1898 he became second vice president. In 1914 he was elected president of the Crane Co. On three occasions, Mr. Crane had made gifts to the veteran employes of his personal stock in the company, benefitting 10,000 to 12,000 long-time employes.

John H. Borden, 53, for many years purchasing agent, American Radiator Co., New York, died Nov. 2 at Oak Park, Ill.

Lewis Taylor Robinson, engineer in charge of the general engineering laboratory, General Electric Co., Schenectady, N. Y., died at his home on Nov. 3, at the age of 63 years.

William Louden, founder of the Louden Machinery Co., Fairfield, Iowa, died November 5 at his home in Fairfield. Mr. Louden was 90 years old.

Edward D. Boeck, 75, former superintendent of the foundry of the American Radiator Co., Buffalo, died recently. He was with the company for 44 years prior to his retirement. Besides serving as its foundry superintendent he opened the branch plant of the company in Schoenback, Germany.

Mathew Hanley, assistant foundry foreman, the Charles Parker Co., Meriden, Conn., died recently. Mr. Hanley was born in Terryville, Conn., in 1877 and moved to Meriden when a boy. He started work in the foundry of the Charles Parker Co., in 1894 and was connected with that firm for 37 years.

Thomas Spence, 81, president of the Rundle-Spence Mfg. Co., Milwaukee, manufacturing plumbing and heating supplies, died recently after an illness of six weeks. He was a native of Milwaukee and as a youth became connected with the Rundle Mfg. Co., acquiring an interest in 1871, when the name was changed to its present form. Later he became president.

James E. Grant, retired Detroit foundryman, died recently at his home in Royal Oak, Mich. Mr. Grant, the son of a foundryman who came from England and was one of the pioneers in foundry work in Detroit, was born in Bradford, Ont., in 1847. During his career in the foundry industry, he was connected with several companies including the Peninsular Car Co., and the Fulton Iron and Engine Co. He served for 20 years as foundry foreman for the Cadillac Motor Car Co., Detroit, retiring 15 years ago.

Stephen S. Hall, chairman of the board of directors, Pickering Governor Co., Portland. Conn., died recently. Mr. Hall was born Jan. 18, 1864, and became affiliated with the Pickering company in 1881. In July of this year, he celebrated his fiftieth year with the company. He was an inventor of note and had added several important improvements to the products manufactured by the Pickering company. He was a member of several technical societies and was active in civic and other organizations.

Robert H. Ripley, 55, senior vice president, American Steel Foundries,

Robert H. Ripley

Chicago, and chairman of the board, General Steel Castings Corp., Eddystone, Pa., and Granite City, Ill., died Nov. 5 at Chicago. He was identified with the steel castings and steel railway equipment industries his entire business career of more than 30 years, with the exception of about one year. In that interval he practiced law in Chicago following his graduation from Cornell university in 1899. He was vice president, American Steel Foundries since 1906 and for the past two years, the company's senior vice president. When R. P. Lamont resigned from his various industrial activities early in 1929, prior to becoming secretary of commerce, Mr. Ripley succeeded him as president, General Steel Castings Corp., which office he had recently resigned to become chairman of the board. Mr. Ripley was a member of various Chicago clubs.

Frederick A. Riehle, who died recently at his home in Philadelphia at the advanced age of 89 was known practically all over the world as the head of the firm which manufactures testing machines for all conceivable purposes. In 1865 Mr. Riehle bought an interest in a scale manufacturing concern and a few years later with his father and brother bought the remainder. The first testing machine was built to the order of a pipe manufacturer who wanted some tangible evidence to submit in a law court where he was sueing for compensation. He retired from active business several years ago, but maintained his interest in and attended meetings of the various engineering societies in the city. He was one of the charter members of the American Foundrymen's association.

Plans Symposium on Electric Furnaces

Spring convention of the Electrochemical society, the sixty-first annual meeting of the organization, will be held in Baltimore, April 21-23, at the Lord Baltimore hotel. A symposium on the electric furnace and its products will be conducted by J. T. Mackenzie, American Cast Iron Pipe Co., Birmingham, Ala. In connection with this symposium the electro-thermic division of the society is inviting one of the foremost electric furnace engineers of Europe to report upon recent developments in the electric furnace art abroad. An additional feature will be a technical discussion of electrolytic copper and by-products.

Colin G. Fink, Columbia university, New York, is secretary of the society.

Mining Group To Meet

The annual meeting of the American Mining congress will be held at the Mayflower hotel, Washington, Dec. 3-5. Group conferences will be held and it is expected that the president, S. Livingstone Mather, Cleveland, vice president of the Cleveland-Cliffs Iron Co., will present a program for minerals that will include recommendations for the solution of the major problems of the industry.

Book Review

Metallographers' Handbook of Etching, by Torkel Berglund, cloth, 183 pages, 5½ x 8½ inches, published by Isaac Pitman & Sons, New York, and supplied by THE FOUNDRY, Cleveland, for $3.75 plus 15 cents postage, and in London by the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster.

In 1926 G. Malmberg, then vice president of the Society of Swedish Metallographers, proposed the publication of a handbook for etching iron and steel. The proposal was adopted and the work begun in 1927 by B.

Palmgren who was prevented from continuing a short time later. The work then was undertaken and compiled by Mr. Berglund. While at first it was to cover only iron and steel, the interest evinced and requests received, made it advisable to include such nonferrous materials as are met in the industrial laboratory. Following the introductory remarks, a chapter is devoted to the general considerations which include preparation of the specimen, chemistry of etching, types and technique of etching, and heat tinting. Chapter III relates to macroetching of iron and steel with information on preparation of sections, interpreting of macrostructure, the various reagents used, strain etching, sulphur printing and detection of cracks. Microetching of iron and steel is discussed in Chapter IV with data on soft and low carbon steel, normal steel, heat treated steel, alloy steels, cast iron, and methods of identifying nonmetallic inclusions. Chapter V is devoted to the etching of nonferrous metals including copper and copper alloys, nickel and nickel alloys, zinc and zinc alloys, aluminum and its alloys, lead, tin and bearing metals, and silver alloys. The book also contains a bibliography of literature on the subject.

Whiting Corp. Absorbs Grindle Company

Grindle Fuel Equipment Co., Harvey, Ill., for the past 10 years a subsidiary of the Whiting Corp., Harvey, was absorbed by the parent company on Nov. 13, and will be operated as a separate department under the name, Pulverizing & Combustion Equipment division. W. R. Bean, formerly president, Grindle Fuel Equipment Co., has been made vice president of the Whiting Corp. in charge of the newly formed division.

A. S. T. M. Regional for Cleveland Planned

The executive committee of the American Society for Testing Materials has approved the recommendation of the recently formed Cleveland district committee that a regional meeting of the society be held in Cleveland on March 9, 1932. The district committee has suggested that the subject of the regional meeting program deal with rubber and rubber products. Committee D-11 on rubber products is assisting in arranging the program. As is customary, the morning session will be devoted to "The Manufacture of Rubber Products" and the afternoon meeting will deal with "Properties of Rubber as an Engineering Material."

It is planned to schedule the regular 1932 spring group committee meetings of the society for Cleveland during the week of March 7.

DIRECTORY OF FOUNDRY ASSOCIATIONS

American Foundrymen's Association

President, E. H. Ballard, General Electric Co., West Lynn, Mass.; executive secretary-treasurer, C. E. Hoyt, 222 West Adams street, Chicago; technical secretary, R. E. Kennedy, 222 West Adams street, Chicago.

Associated Brass Founders of New England

President, George W. Thornburg, Crescent Park Brass Foundry, Waltham, Mass.; secretary, Herbert H. Klein, Pennsylvania Foundry Supply Co., 310 Congress street, Boston. Meetings the fourth Wednesday of each month at the Engineers' club, Boston.

The Buffalo Foundrymen

President, J. McArthur, Washington Iron Works; secretary, W. J. Wark, E. J. Woodison Co., 140 Chandler street. Meetings each month at club rooms, 140 Chandler street.

Central Illinois Foundrymen's Club

President, H. M. Hire, Hire Foundry Co., Peoria, Ill.; secretary, Franklin Whitehead, The Meadows Mfg. Co., Bloomington, Ill.

Chicago Foundrymen's Club

President, L. E. Gilmore, Crane Co., Chicago; secretary, Albert N. Wallin, S. Obermayer Co., 2563 West Eighteenth street. Meetings first Thursday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, Carl S. Neumann, Union Mfg. Co., New Britain, Conn.; secretary, Charles S. Parker, Charles Parker Co., Meriden, Conn. Meetings are on second Friday of each month in various parts of the state.

Connecticut Nonferrous Foundrymen's Association

President, C. H. Blanchard, Reading Steel Casting Co., Pratt & Cady division, Hartford, Conn.; secretary, C. D. Elliott, Wilcox, Crittenden Co. Inc., Middletown, Conn. Meetings held the second Monday of each month at place to be named. Recent meetings have been held at Hotel Garde, New Haven, Conn.

Detroit Foundrymen's Association

President, James L. Mahon, American Car & Foundry Co.; secretary, Neil I. McArthur, Great Lakes Foundry Sand Co., 2100 Penobscott building, Detroit. Meetings third Thursday in each month, except December, June, July and August at Ft. Shelby Hotel.

East Bay Foundrymen's Association

Secretary, O. R. Moller, Electric Steel Foundry Co. Inc., 1328 Second street, Berkeley, Calif.

Electric Steel Founders' Research Group

Director, R. A. Bull, Central Office, 541 Diversey Parkway, Chicago.

Gray Iron Institute

President, A. E. Hageboeck, Frank Foundries Corp., Moline, Ill.; manager, Arthur J. Tuscany, Terminal Tower building, Cleveland.

Malleable Iron Research Institute

President, R. R. Fauntleroy, Moline Malleable Iron Co., St. Charles, Ill.; secretary, Robert E. Belt, Union Trust building, Cleveland.

Metropolitan Brass Founders' Association

President, William Ember, Jefferson Brass Foundry, 62 Delevan street, Brooklyn, N. Y.; secretary, William E. Paulson, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 2 Park avenue, New York.

New Jersey Foundrymen's Association

President, W. H. Mantz Atlas Foundry Co., Irvington, N. J.; secretary, G. W. Hannay, Barnett Foundry & Machine Co., Irvington, N. J. Meeting called by president. Scheduled meeting dates: Oct. 28, Dec. 2, Jan. 27, 1932, March 23, 1932, May 25, 1932.

New England Foundrymen's Association

President, Luther J. Anthony, Glenwood Range Co., Taunton, Mass.; secretary, Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass. Meetings held the second Wednesday of each month excepting July and August at the Engineers club, 2 Commonwealth avenue, Boston. Outings usually are held in the months mentioned.

Ohio Foundries Association Inc.

President, A. H. Kramer, Advance Foundry Co., Dayton, O.; secretary, Robert Hoierman, 418 Penton building, Cleveland.

Pacific Coast Founders Association

President, Charles J. P. Hoehn, Enterprise Foundry Co., 2902 Nineteenth street, San Francisco; manager, S. M. Truitt, 55 New Montgomery street, San Francisco.

Philadelphia Foundrymen's Association

President, J. B. Greenstreet, Olney Foundry Co., Philadelphia; secretary, Earl Sparks, 1623 Sansom street, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association

President, H. F. Siefert, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; secretary-treasurer, William J. Brant, Wm. J. Brant, Bessemer building, Pittsburgh. Meetings on the third Monday of the month, except in July and August at Fort Pitt hotel.

Quad-City Foundrymen's Association

President, E. A. Gullberg, Union Malleable Iron Works, East Moline, Ill.; secretary-treasurer, Stanley Brah. Meetings the third Monday of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

St. Louis District Foundrymen's Club

President, W. C. Raithel, Century Electric Co., St. Louis; secretary-treasurer, Leo J. Filstead, John C. Kupferle Foundry Co., St. Louis. Meetings the fourth Thursday of the month at 6:30 p. m., at the American Annex hotel, Sixth and Market streets, St. Louis.

Southern Metal Trades Association

President, John S. Schofield, J. S. Schofield's Sons Co., Macon, Ga.; secretary, W. E. Dunn Jr., Flatiron building, Atlanta, Ga.

Steel Castings Development Bureau

Research Director, George Batty, 500 Stock Exchange building, Philadelphia.

Steel Founders' Society of America

President, W. H. Worrilow, Lebanon Steel Foundry, Lebanon, Pa.; managing director, G. P. Rogers, Graybar building, New York.

Tri-City Technical Council

Chairman, C. F. Scherer, Davenport Machine & Foundry Co., Davenport, Iowa; secretary, E. C. Xander, assistant secretary, Tri-City Manufacturers association, Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association

President, William Hoppenjans, The Star Foundry Co., 221 Main avenue, Covington, Ky.; secretary, C. C. Erhart, Chris Erhart Foundry Co., Cincinnati. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association

President, Frederick Christensen, R. R. Howell & Co., Minneapolis; secretary-treasurer, C. E. Langdon, 3849 Lyndale avenue, south, Minneapolis. Meeting third Wednesday of each month at Athletic club.

Washington Foundrymen's Club

President, Rex L. Alexander, Olympic Steel Works, Seattle; secretary, Edward C. Gustin, 3716 Grayson street, Seattle. Meetings second and fourth Tuesdays of each month at the Elks Temple, Fourth avenue and Spring street.

Western Foundrymen's Association

President, H. T. Hornsby, Joplin, Mo.; secretary, E. L. Graham, Acme Foundry & Machine Co., Coffeyville, Kans.

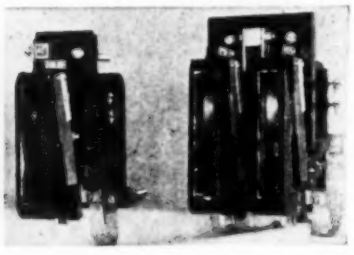
Wisconsin Gray Iron Foundry Group

Secretary, W. F. Bornfleth, Cutler-Hammer Inc., Foundry Division, Milwaukee. Meetings on second Wednesday of each month at Hotel Schroeder, Milwaukee.

Contactor Is Used for Heavy Duty Work

A new heavy duty contactor for crane and general purpose direct current magnetic controllers has been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. These contactors are compact and may be mounted closely together since all parts are removed from the front for replacement.

An effective rupturing capacity is obtained by a new high speed operation and specially designed arc box



Units May Be Mounted Close Together

and horns along which the high flux blowout forces the arc. Fast opening of contacts assists in rapidly extinguishing the arc, and is said to prolong the life of contact tips, arc box and adjacent parts.

The shunt is suspended about the center of rotation of the armature. Bearing pins of the armature and contact arm are nitrided alloy steel with a hard surface.

Market Study Needed for New Conditions

Changing business conditions, brought on by the present industrial situation, are disclosing to many companies that territory divisions, division of customers among salesmen, sales expenses, or even customers themselves, are no longer what they were in the past. In looking forward to the period of expansion that inevitably will follow, these companies are forced to realize that entirely new sales and marketing setups will be required, and at present these organizations are making plans for the requisite changes, according to F. B. Heitkamp, general sales manager, Cincinnati Milling Machine Co., Cincinnati, speaking before the industrial marketing division of the American Management association in Cleveland, Nov. 11.

Mr. Heitkamp declared it a popular fallacy to believe that a market that has produced excellent sales in the past is capable of producing similar sales in the future, citing the instance of one manufacturer who saved much expense and effort by a study, which revealed that he had already saturated his market.

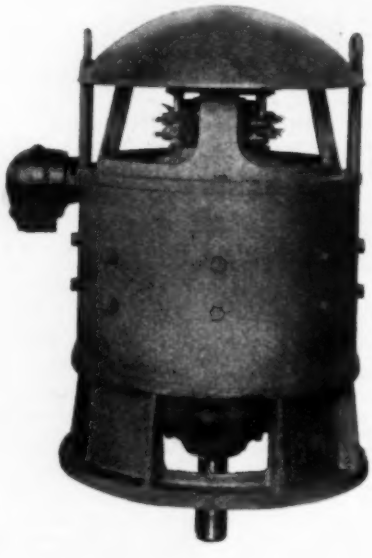
However, the speaker warned that unless market research is undertaken with the object clearly in view, unless it is intelligently supervised and unless it is carried out accurately, it may occasion a waste of time, and expense, and lead to faulty conclusions. Probably the greatest opportunities for research lie in the direction of fitting the product to the needs of the consumer, it was stated.

The problem of engineering service in industrial selling is one which often is met by using two salesmen, one a contact man and the other an engineer. An advantage over this method is to develop representatives who would be trained primarily for sales functions, but possessing enough technical education or experience to enable them to handle a technical discussion intelligently. The latter method was advocated by Raymond S. Perry, vice president, Ingersoll Milling Machine Co., Rockford, Ill.

Instalment selling, industrial market analysis, factory equipment modernization, personnel management in the foreign field and sales price policies were other subjects covered in the conference which continued through Friday, Nov. 13.

Motor Is Vertical

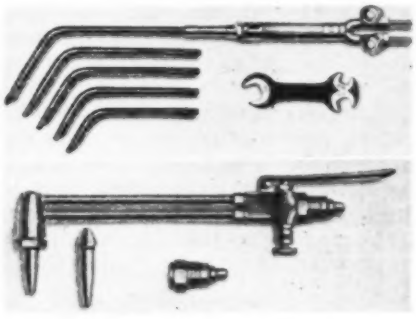
Reliance Electric & Engineering Co., 1042 Ivanhoe road, Cleveland, has developed a line of direct-current motors for vertical operation in sizes up to 50 horsepower and operating at 1150 revolutions per minute. These motors are provided with a ring base for mounting and a drip cover to protect them from falling dirt and chips and from dripping water, oil or other injurious solutions. Where it is desirable the motor can be mounted direct to the machine being driven without the ring base. Large bearings are used to take up the thrust load or weight of the armature. Two heavy eye-bolts are provided to make handling easy.



The Motor Has a Base Ring for Mounting

Attachment Is Light

Linde Air Products Co., 30 East Forty-second street, New York, recently has made two new additions to its line of medium pressure apparatus for oxyacetylene welding and



(Above)-Welding Torch With Five Tips. (Below)-Cutting Attachment

cutting. The new welding torch has a wide welding range, but in spite of this it is light in weight and is designed for perfect balance. The tips are of one-piece, hard-drawn copper construction and are so designed that the head angle can be adjusted easily as desired by the user.

The cutting attachment designed for use with the welding torch will cut metal up to 2 inches in thickness. It is furnished with one and two piece cutting tips. With the cutting attachment the welding torch can be converted into a cutting torch easily and quickly. The cutting attachment weighs only 1 pound 8 ounces.

Book Review

Henley's Twentieth Century Book of Recipes, Formulas and Processes, cloth, 809 pages, 5½ x 8½ inches, published by the Norman W. Henley Publishing Co., New York, and supplied by THE FOUNDRY, Cleveland, for $4 plus 15 cents postage, and in London by the Penton Publishing Co., Ltd., 416-17 Caxton House, Westminster.

From time to time occasion arises in the shop wherein a needless waste of time devoted to the search for some favorite formula, and considerable worry could be prevented by having at hand a reference book containing a wide fund of information. The *Twentieth Century Book* should fill that need as it covers a wide variety of subjects which are arranged alphabetically. The book begins with formulas for acidproofing wood and ends with tests for chrome yellow. Over 30 pages are devoted to alloys whose compositions apparently were gathered

from old sources. For example under aluminum alloys no mention is made of the No. 12 or 8 per cent copper alloy so commonly used or its counterpart the 13 per cent zinc, 2.5 per cent copper alloy used in Europe, etc. Information on brasses and bronzes is sketchy, and considerable space is given to the antiquated method of making phosphorus bronze by adding stick phosphorus. Brief mention is made of phosphor copper and phosphor tin.

However, the various pages devoted to the alloys compose but a small section of the book, and the possessor undoubtedly will find formulas and recipes of value for example in coloring metals, cleaning compounds, rust-proofing, cements for various purposes, paints, varnishes and lacquers, and others on subjects which are too numerous to mention.

Compressor Aids Cooler in Excessive Heat

A combination air and water cooled compressor for use in electrical water coolers in industrial plants where heat is excessive, recently has been developed by the Frigidaire Corp., Dayton, O. The unit will be a part of a new model cooler developed by the company, and is designed to overcome water cooling problems in foundries, steel mills and similar places. An air cooled condenser is used until temperatures rise above normal and the demand on the cooler becomes great. At that time, an automatic regulator brings an auxiliary water cooled condenser into operation, to provide a constant supply of drinking water at proper temperatures. The cooler has a capacity of 13 gallons of water an hour.

Develops New Flux

The Apex Smelting Co., Chicago, recently has developed an aluminum flux which it claims will cleanse the foreign ingredients from aluminum, and dispel the gases and oxides contained in the metal or absorbed during the melting. The mechanical properties of the flux are said to bring the entrapped drosses to the surface of the metal, and liberate metallic aluminum from skimmings.

What the Foundries Are Doing

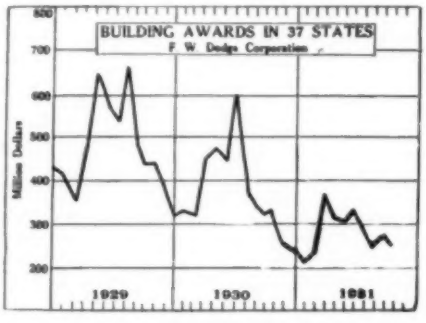
Reflecting the Activities of Gray Iron, Malleable, Steel and Brass Shops

Sessions Foundry Co., Bristol, Conn., now is working four days a week and expects to increase to five.

Kinloch Brass Castings Co., 2356 Palm street, St. Louis, will build a 1-story foundry, 59 x 70 feet.

Allis-Chalmers Mfg. Co. reports unfilled orders as of Oct. 31 totaled $8,101,000 compared with $7,915,000 a month earlier

Production of brass castings in the Chicago district during November increased over the output for September and October.



Plant of the Artcraft Metal Products Co., Martins Ferry, O., manufacturer of stoves and ranges, has been purchased by the Ohio Valley Industrial Corp.

C. Cowles & Co., New Haven, Conn., has discontinued its foundry, according to L. G. Cowles, vice president. The company is buying its castings.

Pipe foundry of Colorado Fuel & Iron Co., Pueblo, Colo., resumed operations recently after being idle for several months. Seventy-five men are employed.

Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, has acquired the Alloy Welding & Mfg. Co., Pittsburgh, welder and fabricator of alloy steel.

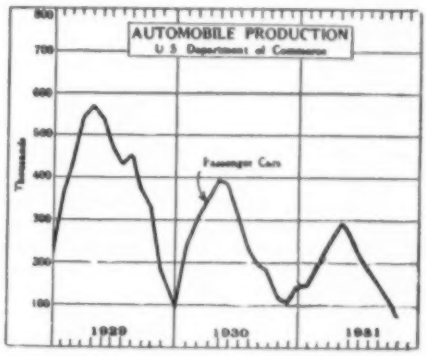
Kruckemeyer & Schrader Foundry Co. has been incorporated with $20,000 capital to operate a foundry at Blanchester, O., by J. Sagmeister, 1106 Traction building, Cincinnati, and associates.

Die Cast & Forge Corp. has been organized by Thomas M. Russell, 55 East 95th street, New York, and Frederick R. Rohlff, 2101 Beekman place, Brooklyn. The company will manufacture die castings, hardware specialties, etc.

Amesbury Brass & Foundry Co., Amesbury, Mass., manufacturer of display cases for frozen foods, has taken over remainder of the buildings it has occupied in part and will enlarge production.

Elmer Frees, former president, Midwest Stove & Enameling Co., and George Baker, former president, Baker Stove Works, recently were appointed receivers for the Midwest Stove & Enameling Co., Belleville, Ill.

Cary Wright has been appointed manager of the Ideal Furnace Co., Milan, Mich., succeeding Everett Betts, who has resigned. Mr. Wright formerly was connected with the United States Radiator Corp.



Saco-Lowell Shops, Boston, is considering the consolidation in Biddeford, Me., of its Newton Upper Falls, Mass. and Biddeford, Me., plants. No definite decision has been reached regarding the proposed consolidation.

Flour City Ornamental Iron Co., division of General Bronze Corp., Minneapolis, will make all the aluminum windows, spandrels and other ornamental metal work for the new $21,000,000 Chicago post office. Contract for the ornamental metal work totals $750,000.

American Manganese Steel Co., Chicago, has awarded a contract to the Volta Mfg. Co., Welland, for rebuilding of the furnaces at its newly-acquired plant in Dennistown street, Welland,

RAW MATERIAL PRICES

Nov. 19, 1931

Iron	
No. 2, foundry, Valley	$16.00 to 16.50
No. 2 Southern, Birmingham	12.00
No. 2 foundry, Chicago	17.00
No. 2 foundry, Buffalo	17.00
Basic, Valley	15.00 to 15.50
Basic, Buffalo	16.50 to 17.00
Malleable, Chicago	17.00
Malleable, Buffalo	17.50
Coke	
Connellsville Beehive coke	$3.25 to 4.50
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.00
Scrap	
Heavy melting steel, Valley	$9.50 to 10.00
Heavy melting steel, Pitts.	10.00 to 10.50
Heavy melting steel, Chicago	7.75 to 8.25
Stove plate, Buffalo	8.50 to 8.75
Stove plate, Chicago	7.00 to 7.50
No. 1 cast, New York	7.00 to 7.50
No. 1 cast, Chicago	8.00 to 8.50
No. 1 cast, Philadelphia	11.50
No. 1 cast, Pittsburgh	10.00 to 10.50
No. 1 cast, Birmingham	9.00 to 10.00
Car wheels, iron, Pittsburgh	10.00 to 10.50
Car wheels, iron, Chicago	9.00 to 9.50
Railroad malleable, Chicago	8.00 to 8.50
Agricultural mal., Chicago	7.50 to 8.00
Malleable, Buffalo	10.00 to 10.50
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	6.50 to 7.00
Straits tin	23.00
Aluminum, No. 12, producers	22.00
Aluminum, No. 12 remelt	8.50 to 9.50
Le d, New York	3.95
Antimony, New York	6.65
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	3.22½ to 3.25

Ont. Other contracts for rehabilitation of the plant are to be awarded shortly.

Norwalk Lock Co., South Norwalk, Conn., soon will consolidate its manufacturing activities with those of the Segal Lock & Hardware Co., Brooklyn, N. Y., of which it is a subsidiary. The Brooklyn plant of the Segal company will be closed and manufacturing activities will be centralized at the plant of the Norwalk company.

Foundry operations in the Pittsburgh district have improved mildly over the past 30 to 60 days, although the average rate still is not much if any above 25 per cent. Most jobbing foundries continue on a part-time basis. Schedules of radiator and sanitary ware producers are slightly below the October rate, while ingot mold production is moderately heavier.

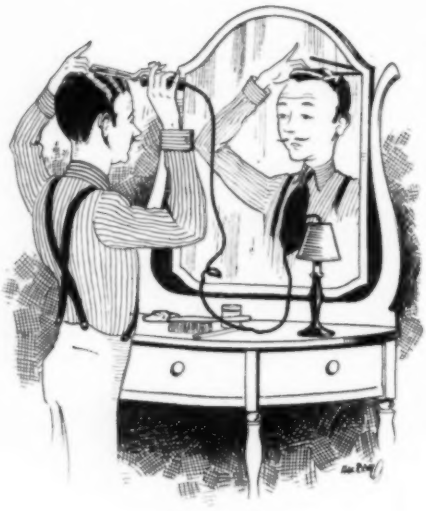
Following the withdrawal of George Troutman, Sidney, O., from the management of the Wapak Hollow Ware Co., South Willipie street, Wapakoneta, O., the management was taken over by the following employes. H. T. Kennedy, Roy Cole, Dave Hole, J. A. Hemmert and Raymond Pohlabeln. The company specializes in gray iron and aluminum castings.

Shawinigan Chemical Co. Ltd., Montreal, Can., has been licensed by the Duriron Co. Inc., Dayton, O., to produce Duriron in Canada and Newfoundland. The Shawinigan company will make a complete line of pumps, valves, pipe and fittings and special castings for acid handling service. This is the first company outside the United States to be granted a manufacturing license by the Duriron company.

Krischers Mfg. Co., 255 Calyer street, Brooklyn, N. Y., recently has taken over the plant formerly occupied by O. B. North & Co. Inc., 67 Franklin street, New Haven, Conn., and has begun the production of gray iron and malleable castings for its own consumption. The company intends to begin the production of brass castings sometime in the future. H. G. Hancock is general superintendent of the New Haven plant and A. G. Anderson is foundry superintendent.

Pettibone, Mulliken Co., Chicago, producer of castings for the railroad and other industries, has been adjudged solvent by United States District Judge Carpenter, and the petition in bankruptcy filed against the corporation in Chicago by three note holders has been ordered dismissed by the federal court.

Faked Foundry Facts



Electric Refining

C. H. Eib, president of the company, pointed out to the court that Pettibone, Mulliken Co. has no unpaid current obligations, has discounted and is discounting all its bills, and owes nothing except its funded debt, none of the principal amount of which is due. It was declared assets exceed total liabilities, consisting only of its funded debt, by more than $4,000,000.

Murray Copper & Bronze Co., Pittsburgh, now incorporated, has purchased the good will, plant and equipment of the Wayne Brass Foundry Co., Pittsburgh, and the Murray Copper & Bronze Co., not incorporated, and is now operating at 4635 Butler street, Pittsburgh. The Murray company for more than 25 years has engaged in the production of bronze and copper castings for steel rolling mills, copper tuyeres, coolers, bosh plates, valves and other accessories for blast furnaces, open-hearth and heating furnaces and castings for bank vaults, railroad journal bearings and miscellaneous applications. It also has designed and developed new equipment for water cooling blast furnaces and bearings for rolling mills. Mont Murray continues as president of the new company.

New Trade Publications

HEAT-RESISTANT ALLOY—American Manganese Steel Co., Chicago Heights, Ill., in a current bulletin lists and illustrates a wide variety of applications of its alloy steel for resistance to heat, corrosion and abrasion.

DIE CASTINGS—Zinc die castings for a large number of uses are illustrated and described in an attractive booklet recently distributed by the New Jersey Zinc Co., 160 Front street, New York.

AIR COMPRESSORS—Quincy Compressor Co., Quincy, Ill., in a recent bulletin describes its new compressor unit, automatic, two-stage, air-cooled. The compressor is illustrated and described and a table of dimensions is given.

MOTORS—General Electric Co., Schenectady, N. Y., has issued several bulletins on its line of electric motors, including single-phase vertical motors, constant-speed, single-phase motors, and general-purpose, synchronous motors.

SAND TESTING APPARATUS—Information on standard screen scale testing sieves for use in molding sand control recently has been issued in bulletin form by the W. S. Tyler Co., Superior avenue and E. 36th street, Cleveland. The use of a testing sieve shaker also is described.

PYROMETERS—A bulletin on its potentiometer pyrometer line has been issued by the Brown Instrument Co., Philadelphia, calling attention to its shop ruggedness and laboratory accuracy. Various details of construction are illustrated in halftone, with description appended.

BALL BEARINGS—Eighth edition of its price and data book has been issued by the New Departure Mfg. Co., Bristol, Conn., containing important revisions and additions to previous listings of types, capacities, dimensions and mounting details for engineer and designer. A marginal index aids greatly in finding various sections.

FLEXIBLE COUPLINGS—Clark Coupling Co., 149 Church street, New York, has issued a folder describing and illustrating its new type of flexible coupling. Three general classifications are described, one for general or heavy duty drive, one for medium duty, high speed, steady load drive, and one for marine applications.

INDUSTRIAL RAILWAYS—A brief pictorial summary or classification of the line of industrial railway equipment manufactured by the American Car & Foundry Co., 30 Church street, New York, is included in a publication of that firm. Essential data on cars, tracks, trailers, trucks, skids and auto truck dumping bodies also have been included.

ARC WELDERS—The characteristics of the new arc welding machines developed by the General Electric Co., Schenectady, N. Y., are illustrated and described in a bulletin recently issued by that company. It is pointed out that the outstanding feature of the welder is its ability to recover full voltage immediately after the welding circuit is open.

UNIT HEATERS—L. J. Wing Mfg. Co., 154 West Fourteenth street, Newark, has issued a catalog on its featherweight unit heaters, featuring a new model built around a new heating element. Illustrations show details of the installations and diagrams illustrate distribution of heat under various plans of installation. Tables of engineering data also are presented, including piping and wiring diagrams.

ELECTRIC TRUCKS—How its electric trucks can be modified to meet particular needs of various industrial situations is the subject treated in a booklet by the Elwell-Parker Electric Co., Cleveland. Illustrations show various applications of electric trucks designed for special handling jobs. The booklet gives hints to manufacturing executives relative to handling materials and to engineers interested in plant layout.

POWER TRANSMISSION—Coventry Chain Co. Ltd., Coventry, Eng., and Hans Renold Ltd., Manchester, Eng., associated companies, have issued a combined catalog of products for industrial application. A statement is made of the policies concerning marketing of the products of the associated companies. The catalog covers a large assortment of chains, chain drives and accessories sufficient to cover a wide range of industrial needs.

AJAX

COPPER

PHOSPHOR BRONZE
NICKEL SILVER
RED BRASS
YELLOW BRASS

ZINC

DESIRABLE FEATURES

OF THE

AJAX WYATT

Electric Melting Furnaces

Noiseless
Easily Operated
Perfect Control
Charges Uncontaminated
Superior Performance
Best Working Conditions

LOWEST COST

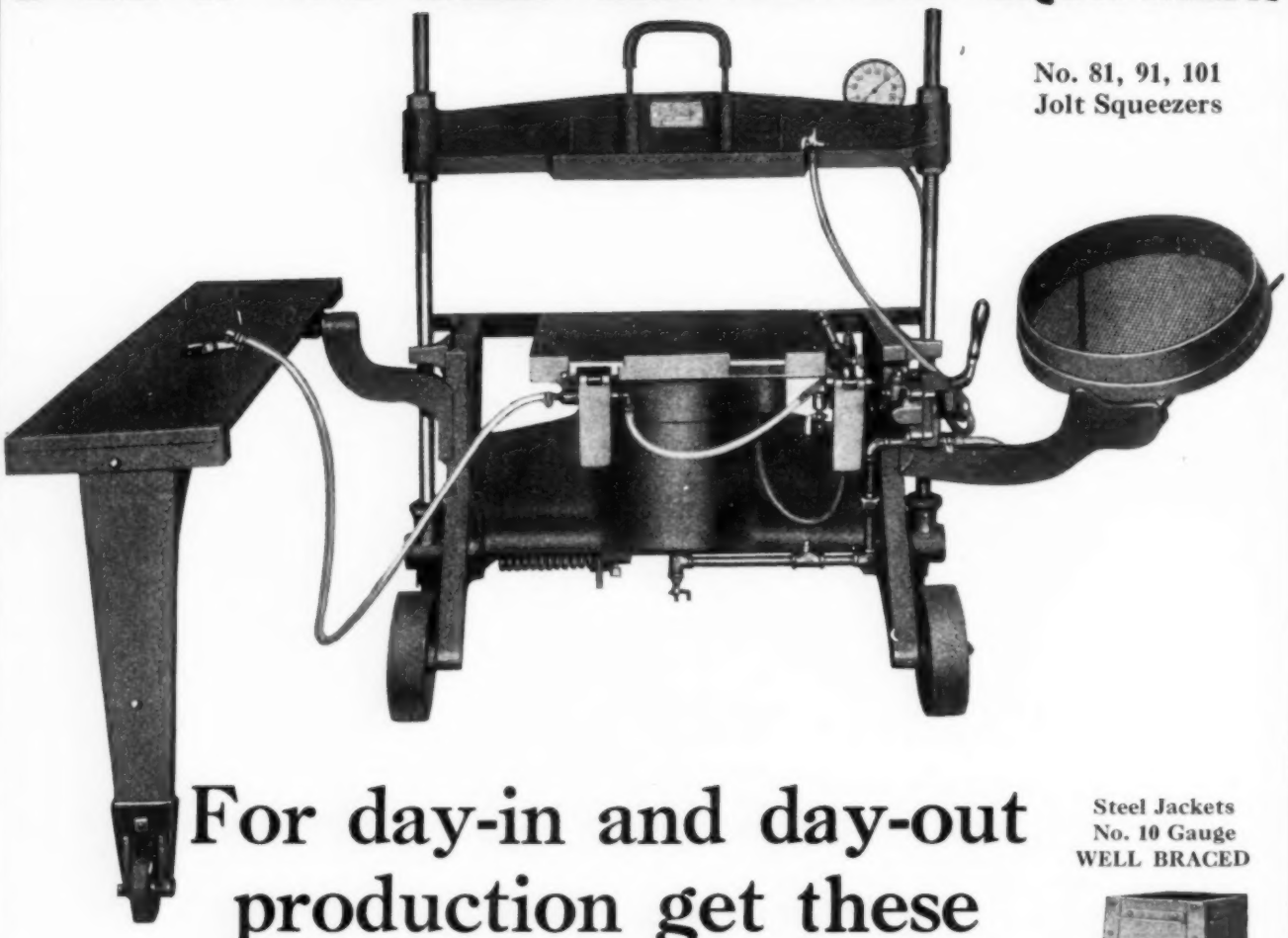
Shop Cleanliness: **No auxiliary dust gathering devices required for the elimination of zinc oxide, fumes or gases.**

AJAX ELECTRIC FURNACE CORPORATION
DIVISION OF THE AJAX METAL CO.
PHILADELPHIA

AJAX

AJAX

ARCADE MOLDING MACHINES AND FOUNDRY EQUIPMENT



No. 81, 91, 101
Jolt Squeezers

For day-in and day-out production get these sturdy machines.

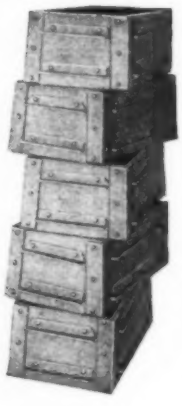
They Stand the Gaff!

Specifications	No. 81	No. 91	101
Distance between uprights	32″	36″	38″
Diameter Jolt Cylinder	3″	4″	5″
Diameter Squeeze Cylinder	8½″	10″	13″

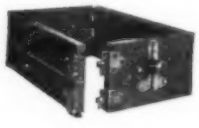
Ask for Bulletin 31-C

Ask for prices — — no obligation

Steel Jackets
No. 10 Gauge
WELL BRACED



Cherry Flasks
MILLED PINS
AND EARS



Arcade Manufacturing Company Freeport, Illinois U. S. A.

CHROMIUM

PRODUCES WEAR-RESISTING IRON

without Expensive Chills

FOR years, foundrymen have cast iron against metal chills to produce hard, abrasion-resisting areas by preventing the formation of graphitic carbon. This method is difficult, slow, and expensive.

Today, there is a new method of producing wear-resistant iron which eliminates the use of metal chills.

Chromium prevents the formation of graphitic carbon throughout the casting. The cost of chromium is lower than the first cost of a metal chill; and since a chill is unnecessary, the subsequent cost of setting and handling is eliminated. The iron produced is ideal for such castings as rolls, crusher jaws, grinders, plow points, car wheels, and permanent molds.

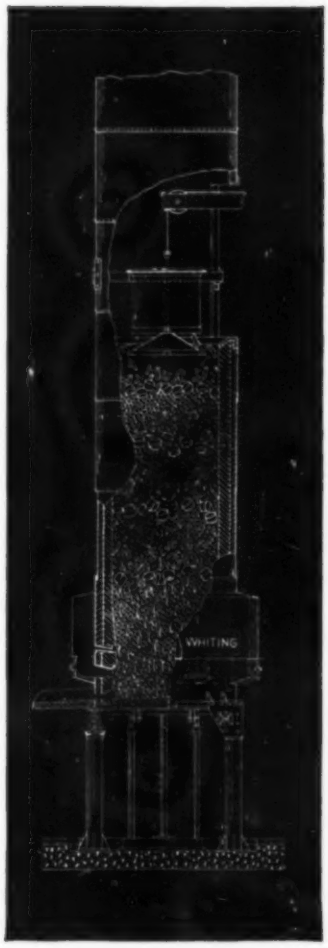
Chromium can be added in the cupola in the form of E. M. CHROMIUM BRIQUETS. For ladle additions, either Electromet Ferrochrome or Electromet Special Low-Melting-Point Ferrochrome is available.

Electromet Engineers will be glad to study conditions in your foundry and recommend the alloy most suitable for your particular needs. Write for further information.

ELECTRO METALLURGICAL SALES CORP.
Unit of Union Carbide and Carbon Corporation

UCC

Carbide and Carbon Building, 30 E. 42nd St., New York

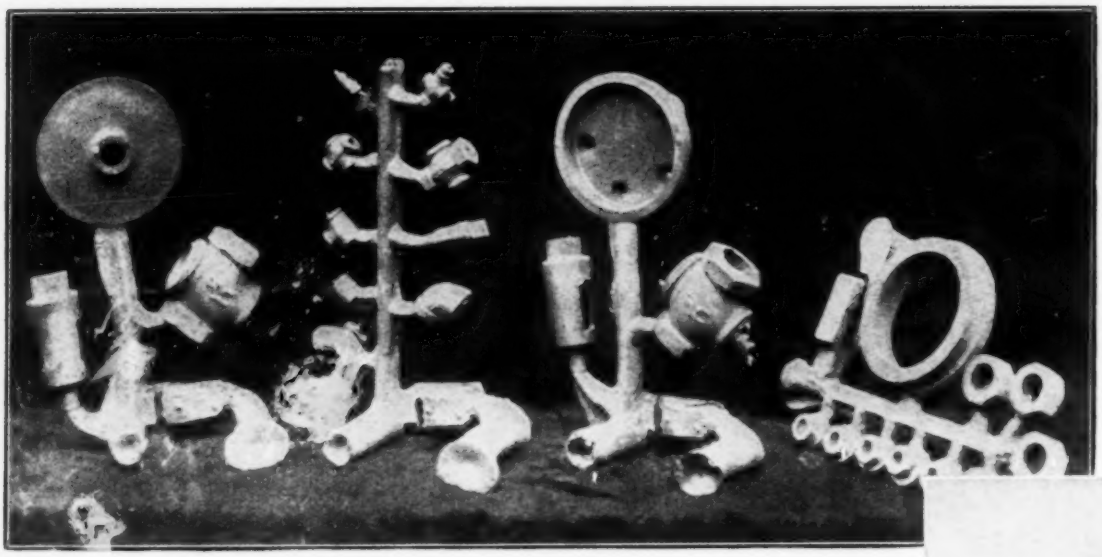


A REFRACTORY binder protects the alloy content of E. M. BRIQUETS from premature oxidation. At the hottest zone of the cupola, the binder disintegrates and releases the full charge of the uncontaminated element to the iron. Recovery is higher. Thorough solution is assured. Guesswork and waste are eliminated.

Electromet Ferro-Alloys now available in briquet form include

E. M. SILICON BRIQUETS (round)
E. M. CHROMIUM BRIQUETS (hexagonal)
E. M. MANGANESE BRIQUETS (square)

Electromet
Ferro-Alloys & Metals



Ordinary methods of gating and molding produce sound castings of EVERDUR

EVERDUR

requires no special foundry equipment

Everdur . . . an Anaconda alloy of Copper (96%), silicon and manganese . . . is superior to "tin bronzes" in strength and machinability, and is highly resistant to corrosion. Because of these properties, and its moderate cost, the use of Everdur is expanding rapidly.

Everdur is furnished in 25-lb. notched ingots, and can be handled with the regular equipment of brass and bronze foundries. Everdur casts well in green sand, chilled or baked molds, and by the centrifugal process. The dense, close-grained castings produced minimize rejection in foundry and machine shop.

Experienced foundrymen have found that the fluidity of Everdur makes possible unusually intricate castings. Write for Publication E-1, containing suggestions for melting, molding, gating and pouring.

EVERDUR
Reg. U. S. Pat. Off.

If you would like to test Everdur metal in your foundry, a standard size 25-lb. ingot will be sent you without charge.

THE AMERICAN BRASS COMPANY
General Offices: Waterbury, Connecticut
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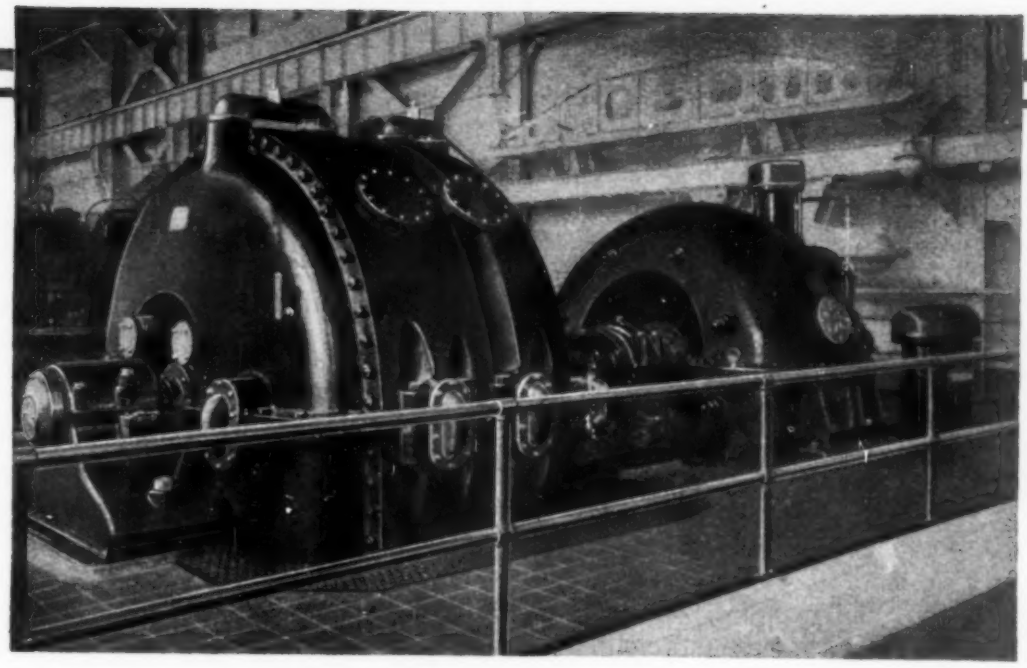
Canadian Plant: ANACONDA AMERICAN BRASS LTD.,
New Toronto, Ontario

ANACONDA
from mine to consumer

ANACONDA COPPER & BRASS



30 G-E BLOWERS

Purchased By COMPANY No. 4 for blowing cupolas and blast furnaces

WHY?

In 1930, when all major purchases of plant equipment were scrutinized with unusual care, the following large orders for G-E blowers were among those placed:

Company No. 1	16 Units
Company No. 2	62 "
Company No. 3	15 "
Company No. 4	30 "
Company No. 5	8 "
Company No. 6	14 "
Company No. 7	15 "
Company No. 8	6 "
Company No. 9	6 "
Company No. 10	5 "
Company No. 11	15 "
Company No. 12	6 "
Company No. 13	6 "
Company No. 14	27 "

Ask the General Electric salesman serving your organization to submit a report showing the savings you can make in your plant with G-E blowers.

GENERAL ELECTRIC

321-73

HERE!—to stay

is the day of alloy cast iron.

The efficient use of the newer cutting tools calls for machine redesign to give greater strength and rigidity, higher power and speeds. Better castings must be had. And the answer is "Nichrome" B Alloy Cast Iron.

TRADE MARK REG. U.S. PAT. OFF.

Nichrome B

is an alloy of nickel and chromium, developed for ladle addition, which melts readily, mixes thoroughly and brings about certain uniform, advantageous changes in the physical characteristics of the iron to which it is added without loss of chromium.

"Nichrome" B is an easy, practical, flexible, economical means of making the alloy addition. "Nichrome" B produces castings of dense grain structure and reduced porosity; harder castings, but easier to machine; stronger, tougher castings that withstand wear and abrasive action. You know the advantages of cast "Nichrome" and sheet "Nichrome" carburizing containers—why not specify "Nichrome" B addition to your Cast Iron.

DRIVER-HARRIS COMPANY
HARRISON, N. J.

Other Plants at
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England France Italy
Offices and Warehouses
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1138 W. Washington Blvd., Chicago
638 New Center Bldg., Detroit
Distributors
Debevoise-Anderson Company
New York Boston Philadelphia
H. L. E. Meyer, Jr., & Co.
San Francisco, Los Angeles, Cal.

POPULAR FALLACIES OF INDUSTRY

WITH a serious deficit staring them in the face foundry executives look frantically for the underlying cause. And—hoodwinked by a popular fallacy—many blame "the times."

★ ★ ★

Asked what they've done to meet the situation they reply, "We've cut corners . . . made savings with such and such equipment, simplified certain processes, and reduced our overhead in all these departments."

When such measures fail to turn red figures into black, foundry owners might as well face the facts: *Perhaps their plant is at fault.* Foundry buildings, long obsolete, or floor space blocked by columns that cause backtracking and prohibit straight-line production—or scattered, inefficient units—all breed "White Elephants."

Plants geographically off-center—paying the penalty of heavy freight charges—are often more to blame for dwindling profits than "the times."

Austin Engineers have helped many a foundry operate profitably—even at fractional capacity—by providing flexible straight-line layouts. In other instances, they've built modern foundries in new strategic centers to help firms "get out of the red"—at *bargain costs* . . . with *15 to 25% savings.*

If your foundry is playing a losing game—after you've checked and double checked every part of the business, why hesitate to consult with an outside organization? In these times no one can afford to overlook any opportunities. Why not grant Austin a brief interview which may bring you ideas that will have an important bearing on your business NOW and for years to come? Phone, wire, write or use the memo below.

THE AUSTIN COMPANY

Foundry Engineers and Builders . . . **Cleveland**

NEW YORK CHICAGO PHILADELPHIA PITTSBURGH CINCINNATI
THE AUSTIN COMPANY OF TEXAS: DALLAS
THE AUSTIN COMPANY, LIMITED, TORONTO

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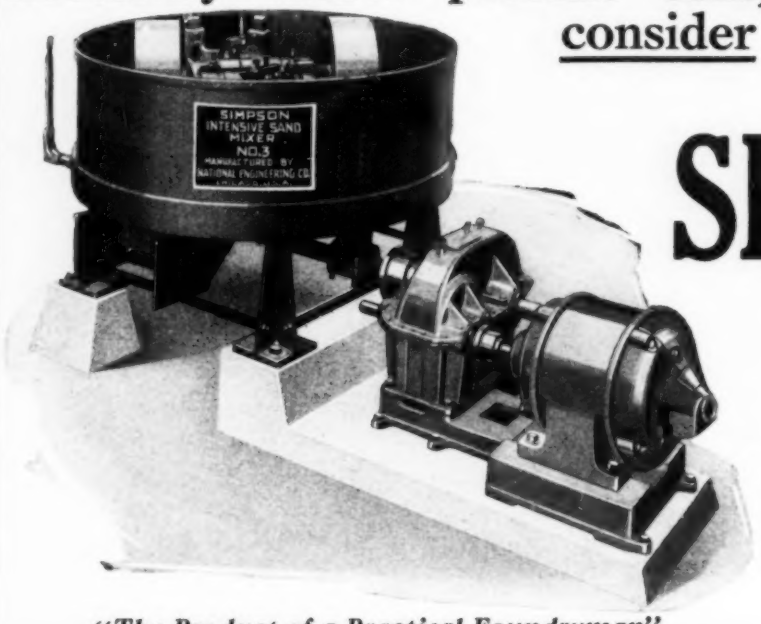
MEMO TO THE AUSTIN COMPANY, CLEVELAND: ☐ Send us "The Return Trip to Profits." Without obligation we will be glad to match some of our time with yours. ☐ We would like to know about the new and extra savings made possible by your *ELEKTRO-DESIGN*. Individual.....
Firm.....City.....F-12-15-31

FOR A START!

On a conservative program for sand control, necessary under present competitive conditions, consider what can be done with the



"The Product of a Practical Foundryman"

SIMPSON INTENSIVE SAND MIXER as a NUCLEUS!

AT A COST but slightly greater than the mixer itself, you can secure mechanical means for screening the sand, removing magnetic refuse, loading the mixer and aerating the sand after mixing—advantages heretofore available only in relatively elaborate and expensive installations, beyond the reach of the medium and smaller capacity foundry. Low head room and limited floor space are not obstacles to the utility of these simple mixer units, and later a distributing belt can be added to provide overhead sand as required.

It will pay you to investigate with us at once, and duplicate the tremendous economies of complete sand treatment and control in your foundry.

WE SPECIALIZE ON SAND PREPARING, SAND RECLAIMING, SAND HANDLING AND MOLD HANDLING EQUIPMENT FOR THE FOUNDRY.

NATIONAL ENGINEERING COMPANY

MACHINERY HALL BUILDING *549 W. WASHINGTON BLVD.*

CHICAGO, ILL., U. S. A.

In This "*Survival of the Fittest*" Where Will You Finish?

SURE, competition is tougher than ever. There isn't much business, and it's harder to get. Only the fittest will survive. Whether or not you will be one of the survivors may depend on your melting costs.

Foundries operating with efficient installations of plumbago (graphite) crucibles and associated melting equipment are making new and surprising records today for economy in melting.

Such performance is possible only because crucible-melting equipment is most economical in investment outlay, in fixed costs, in every phase of operation, and in maintenance expense.

So that you may compare your own costs with those of foundries operating with efficient crucible-melting equipment, let us send you complete data on cost studies in a number of foundries operating under a wide variety of conditions. Write for this data today. It may be your first step towards lower melting costs . . . and definite aid in your efforts to survive present-day competition and conditions. Write any of the following companies:

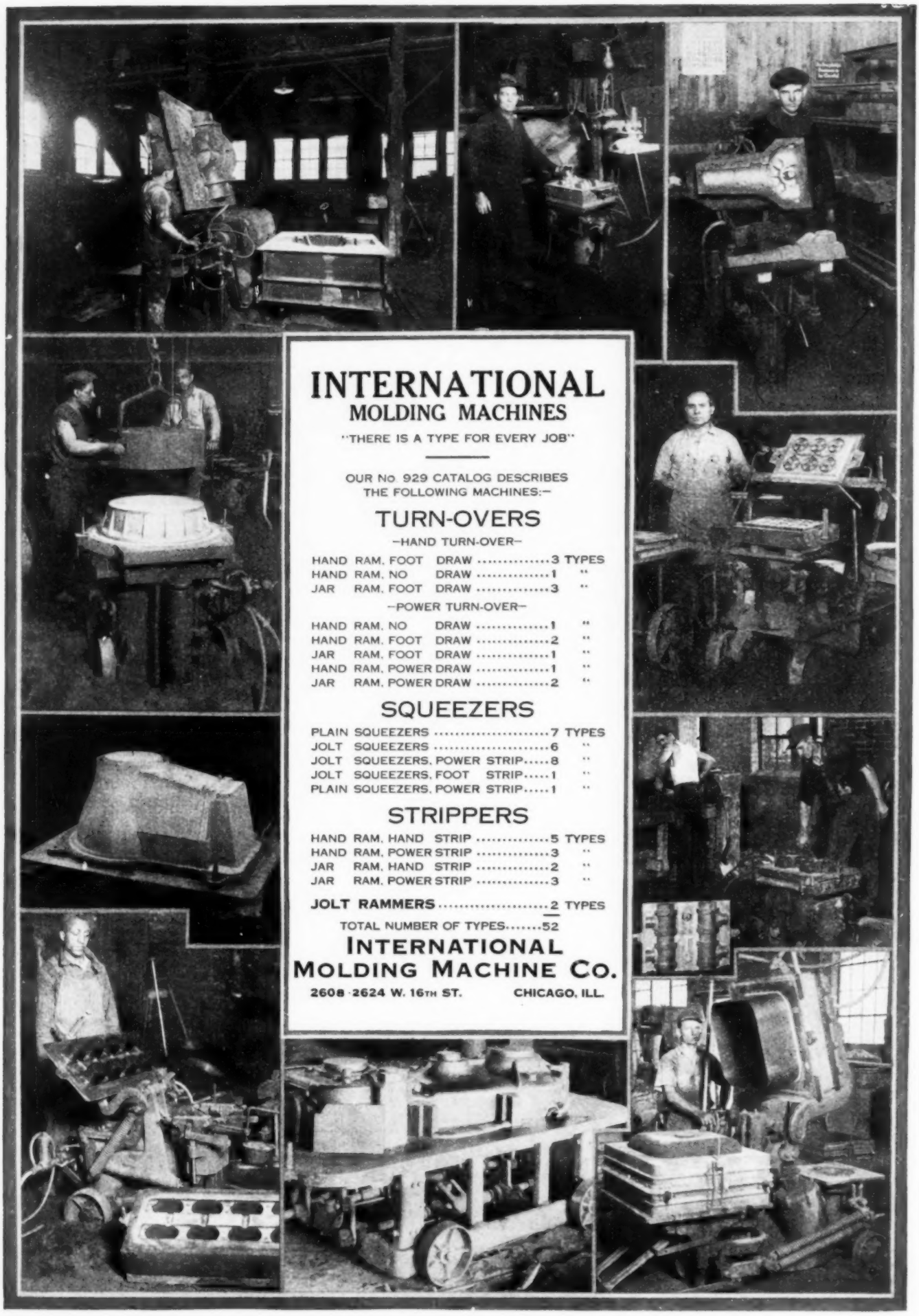
Lava Crucible Co. of Pittsburgh, *Pittsburgh, Pa.*
Chicago-Naugatuck Crucible Co., *Shelton, Conn.*
Ross-Tacony Crucible Co., *Tacony, Phila., Pa.*
Vesuvius Crucible Co., *Swissvale, Pa.*
Bartley Crucible & Refractories Co., *Trenton, N. J.*
Joseph Dixon Crucible Co., *Jersey City, N. J.*

Remember! ONLY

PLUMBAGO (GRAPHITE)

CRUCIBLE-MELTING

Gives Crucible Quality, Flexibility, Adaptability, Reliability and Economy



INTERNATIONAL
MOLDING MACHINES

"THERE IS A TYPE FOR EVERY JOB"

OUR No. 929 CATALOG DESCRIBES
THE FOLLOWING MACHINES:—

TURN-OVERS

—HAND TURN-OVER—

HAND	RAM, FOOT	DRAW	3	TYPES
HAND	RAM, NO	DRAW	1	"
JAR	RAM, FOOT	DRAW	3	"

—POWER TURN-OVER—

HAND	RAM, NO	DRAW	1	"
HAND	RAM, FOOT	DRAW	2	"
JAR	RAM, FOOT	DRAW	1	"
HAND	RAM, POWER	DRAW	1	"
JAR	RAM, POWER	DRAW	2	"

SQUEEZERS

PLAIN	SQUEEZERS	7	TYPES
JOLT	SQUEEZERS	6	"
JOLT	SQUEEZERS, POWER STRIP	8	"
JOLT	SQUEEZERS, FOOT STRIP	1	"
PLAIN	SQUEEZERS, POWER STRIP	1	"

STRIPPERS

HAND	RAM, HAND STRIP	5	TYPES
HAND	RAM, POWER STRIP	3	"
JAR	RAM, HAND STRIP	2	"
JAR	RAM, POWER STRIP	3	"
JOLT RAMMERS		2	TYPES

TOTAL NUMBER OF TYPES.....52

INTERNATIONAL MOLDING MACHINE CO.

2608-2624 W. 16TH ST. CHICAGO, ILL.

You can do it *with* Mayari ★

MODERN design and production methods often bring difficult problems to the foundryman.

HERE IS AN EXAMPLE of a foundry problem solved by the use of Mayari. Cast-iron chilled tires were needed for use in muck-mill rolls, grinding silicon rock. The tires were required to have 1¼-in. chill, with machinable back. In the above section from one of those tires, made with Mayari in the mixture, note the gradation from hard white to soft gray iron. The Brinnel hardness varied from 485, on the chilled portion of the casting, to 163 on the soft, machinable back.

For example, a casting may be required possessing extreme hardness on one face of a section while the opposite side must be readily machinable. Or, perhaps additional strength is required in certain sections without increasing the sectional thickness. Or, as often happens, the castings must have a dense, uniform structure and pressure-tightness; or ability to resist wear, heat or chemical action.

In the solution of these and many similar problems, Mayari offers the foundryman a simple, effective and economical means of obtaining the desired results.

Mayari is a natural nickel-chromium alloy pig iron. Added to the mixture in the cupola, it imparts strength and toughness, dense uniform grain, reduced internal shrinkage, increased resistance to heat, wear and certain kinds of chemical action, and uniformly good machinability. Moreover the desired improvements are obtained at a very slight additional cost, because only a small percentage of Mayari Pig Iron need be used.

Consult our Mayari Service Department. Its purpose is to aid foundrymen to obtain the best possible results in the most economical way. Inquiries are invited from foundrymen everywhere on the various uses of Mayari and its possible application to the solution of their casting problems.

BETHLEHEM STEEL COMPANY
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BETHLEHEM
- Producer of Mayari

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150-F.

FOR CASTINGS THAT MUST BE RIGHT

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Each Semet-Solvay Sales Office has experienced men available who understand every step of foundry operation. Their services are available to the Foundry Industry for any problem involving production. Send for them—without expense or obligation—when in need of practical assistance.

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CRANES and TRANSFER BRIDGES

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